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HUMAN-NATURE RELATIONSHIPS AND NUTRIENT MANAGEMENT PRACTICES OF ILLINOIS FARMERS

BY

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THESIS

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ABSTRACT

Human-nature relationships are the way in which people relate to nature. Although this relationship has been extensively theorized, systematic and empirical investigations are numbered. This study of Illinois farmers builds upon the existing typological approaches with a novel framework and unexplored population. The participants are central to industrial agriculture in the US Corn Belt and thus the global challenge of nitrogen management evolving around the use of artificial fertilizers. Mitigation of the hypoxic zone in the Gulf of Mexico epitomizing this challenge necessitates the integration of social science-based approaches. Prior studies have shed light on the potential relevance of human-nature relationships to farmers' decision making, and this study takes a mixed-methods approach to investigate how farmers in a watershed of east-central Illinois relate to their land and how this relationship associates with their nutrient management practices. The four hypothesis of this study are: (1) Respondents are expected to agree with multiple relationship types. (2) Human-nature relationships of farmers are expected to differ from that of the general populations studied previously. (3) Conservation interests among farmers are expected to be positively related to ecocentric tendencies and negatively with anthropocentric tendencies. The relative strengths of associations between relationship types and conservation are expected to parallel the typology's spectrum from ecocentrism to anthropocentrism, with the most ecocentric type expected to have the strongest association. (4) Human-nature relationships are expected to be most closely associated with interest in conservation, followed by willingness to adopt practices and then behavior.

Data from mail surveys and open-ended interviews complemented each other for a diversified understanding of farmers' relationship with nature. Surveys of farm operators revealed high levels of environmentally oriented relationship types such as the Steward and Ecosystem

Services concepts. Interviewees described a strong and affectionate bond with their land. Yet, the acceptance of the Master concept, a relationship of human-nature opposition, was unprecedented compared to previous studies which mostly focused on the European public. Analysis of both survey and interview data revealed that farmers agreed with multiple types of relationship concepts.

Agreement with certain relationship types associated significantly with interest in conservation, willingness to adopt practices, and actual conservation behavior. This was consistent with informants' accounts of a caretaking and collaborative relationship with their land, which at times manifested in the form of conservation practices. Nonetheless, this working relationship with the land also complicated their decision making. For some, bottom-line concerns, values of production, and vulnerability to natural conditions posed sizable constraints on the adoption of conservation practices. Others recognized that nutrient management could be compatible with their business interests. Further, the unique context uncovered ways in which the control and domination of nature, previously thought to be negatively associated with conservation, could manifest as ecologically sound practices.

In uncovering the distinct ways in which Illinois farmers relate to their land, this explorative study contributes to the nascent body of empirical literature on how people relate to nature. Findings substantiate the expected relevance of this concept to conservation practices and inform policy, management, and communication approaches towards the development of efficient, effective, and potentially agreeable solutions to the nutrient challenge.

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CHAPTER 1

INTRODUCTION

The way in which people conceptually relate themselves to nature has been long regarded as a fundamental driver of actions regarding the natural environment (White, 1967; Rehmann-Sutter, 2000). Related concepts such as social representations and images of nature guide attitudes and preferences towards how people manage nature (Schroeder, 2007; Buijs, Fischer, Rink, & Young, 2008), as well as how people interact with nature (van Koppen, 1997). In the past several decades, attention has turned towards how people's conceptual relationships with nature may be influencing their physical interactions with nature (White, 1967; Freudenburg, Fricken, & Gramling, 1995). Changes in this human-nature relationship have also paralleled policy approaches (M. de Groot & W. de Groot, 2009). Indeed, scholars have viewed peoples' relationship with nature as having transformative potential for remedying environmental issues (Scherer & Attig 1983; Rehmann-Sutter, 2000; Simaika & Samways, 2010). This study of Illinois farmers examines human-nature relationships as they relate to farming practices influencing the quality of surface water linked to the Gulf of Mexico.

HYPOXIA AND THE NITROGEN CHALLENGE

East-central Illinois in the US is at the epicenter of the cascading effects of excessive nutrient loading, one of the global Grand Challenges of this century (Perry, Broers, El-Baz, Harris, Healy et al., 2008). The increase in the volume of nitrogen in the nitrogen cycle due to human alteration is a detriment to human health and the ecosystem at regional and global scales, with effects ranging from health concerns and pollution to eutrophication and the greenhouse effect (J. Follett, R. Follett, & Herz, 2010; Socolow, 1999; Galloway, Townsend, Erisman, Bekunda, Cai et al., 2008). A high profile concern is the growing extent of water in the Gulf of

Mexico impacted by levels of dissolved oxygen too low to support marine life (Environmental Protection Agency Science Advisory Board [EPASAB], 2007). Averaging 16,500 km^2 in peak season (EPASAB, 2007), this hypoxic zone is directly associated with nitrates deposited from streams in the Mississippi River Basin (Goolsby & Battaglin 1993; Alexandar, Smith, & Schwarz, 1995). In particular, nutrient loading from the Upper Mississippi River Basin has increased disproportionately, up 150% since the beginning of the 20^{th} century (Turner, Rabalais, Scavia, & McIsaac, 2007). Excessive fertilizer application and artificial drainage on agricultural lands in this region have been identified as the main contributors to hypoxia in the Gulf (David, Drinkwater & McIsaac, 2010).

The hypoxic zone has been the subject of much research, and natural scientists have identified biophysical strategies to remediate the water quality in the Mississippi River Basin. As mitigation is most effective at the point of input (Schipper, Gold, & Davidson, 2010), substantial reductions in nitrogen loadings are necessary (Mississippi River/Gulf of Mexico Watershed Nutrient Task Force 2008). And yet, despite decades of policy measures based on this information (Peterson, 1991), it is said that only 35% of US croplands meet current standards of nitrogen management (Ribaudo, 2011). This reality suggests that research efforts also be directed at understanding the actors who ultimately control the fertilizer inputs.

A NEED FOR SOCIAL SCIENCE

'Wicked' problems such as the nitrogen challenge are complex, requiring a more holistic approach than 'tame' scientific problems with a true-or-false answer (Rittel & Webber, 1973, p. 162; also Surridge & Harris, 2007; Ackoff, 1979). One source of this complexity is the interaction between the biophysical and socioeconomic aspects (Kotchen & Young, 2007). Though physical sciences may address the symptoms, they often fail to remediate underlying

causes (Weber, Memon, & Painter, 2011). Nevertheless, federally funded research efforts in the Mississippi River Basin have yet to adapt to the 'coupling' of social and ecological systems (Hufnagl-Eichiner, Wolf, & Drinkwater, 2011). A multidisciplinary and holistic approach using social and biogeochemical sciences is necessary to meaningfully address such environmental issues.

False assumptions in policy

At present, the human dimensions of natural resource management are often over-simplified and over-generalized. Policies are riddled with false assumptions, such as that landowners and users are homogenous and economically rational (Nowak & Cabot, 2004; Nowak, 1987; Maybery, Crase, & Gullifer, 2005). Many have simply tried to provide information, assuming that farmers would be motivated to alter their practices given sufficient information (Peterson, 1991; Owens, 2000). Such failures to recognize the complexity of the human dimensions are a major reason for the lack of success in previous conservation programs (Korsching & Nowak 1982).

In reality, farmers are anything but a homogenous group (van der Ploeg, 1993; Darnhofer, Schneeberger, & Freyer, 2005; Raedeke & Rikoon, 1997). Despite the common structural framework, some find reason to experiment with alternative farming methods, while others defer to conventional methods (Duram, 1997). Farmers may also vary in their access to information sources, perceptions of environmental problems, and ability to act (Korsching & Nowak, 1982). This diversity in their decision making models may address some of the discrepancy between their attitudes and behaviors (Corselius, Simmons & Flora, 2003). Thus, while technocratic dimensions are certainly present in agricultural issues, it is necessary also to address the socio-cultural dimensions of farmers' actions (Maloney & Paolisso, 2006).

Innovations and advances in science and technology are meaningless without their adoption (Nowak & Korsching, 1998; Lockeretz, 1990). Moreover, ill-advised governance or misunderstood contextual factors can actually lead to unintended and undesirable outcomes (Kotchen & Young, 2007). An understanding of stakeholder perspectives is essential to successful planning (Lokocz, Ryan, & Sadler, 2011) and resource management (Schmitzberger, Wrbka, Steurer, Aschenbrenner, & Peterseil et al., 2005), particularly when working with the uncertainties inherent in projected benefits of conservation practices (Atwell, Schulte & Westphal, 2009).

Benefits of integrative management

The benefits of a more inclusive approach to resource management are abundant. For example, Larson and Lach (2008) discuss the inherent value of a democratic process, as well as substantive and pragmatic effects of access to citizens' knowledge and values and increased local support for outcomes. Ethnographic work with farmers upstream of the Chesapeake Bay provide a case example where farmers chose not to support nutrient management regulations that failed to recognize pre-existing experience and knowledge (Maloney & Paolisso, 2006). While discourse in policy is dominated by the valuation of nature based on its instrumental values for people, research suggests that non-use values may resonate more deeply with the stakeholders in question (van Koppen, 2000). It would seem, then, that it may be in the interest of policy makers to have some understanding of their stakeholders. Such an understanding forms the basis for collaborative work, facilitating the arrival at an agreeable solution with public support (Jacobs & Buijs, 2011).

An understanding of stakeholders translates into a capacity to customize policy and communication approaches to the respective public's needs and views (M. de Groot & W. de

Groot, 2009). Different policy approaches are known to influence different aspects of landowners' decision making (Maybery et al., 2005). Thus, agro-environmental policy makers may be better prepared to design more efficient and effective policies that target and engage various types of farmers once versed with the diversity within a farming population (Nowak, 1987; Nowak & Cabot, 2004; Schimitzberger et al., 2005). In addition, it is increasingly believed that communication strategies may be the key to reconciling differences in beliefs and moving forwards on sustainable agriculture based on common commitments such as heritage and land (Herndl, Goodwin, Honeycutt, Wilson, Graham et al., 2011). Shared ethics about how to relate to nature such as biophilia, the love of life or living systems, may serve as a vessel for conservation (Simaika & Samway, 2010). Such potential of integrative management approaches are critical in a climate of government mistrust (Larson & Lach, 2008; Lokocz et al., 2011).

Socio-cultural influences on decision making

What, then, about stakeholders should be understood? Applied scholars interested in understanding these factors have explored a plethora of potential determinants of conservation behavior, yet found little consistency amongst preexisting studies (Knowler & Bradshaw, 2007). What can be said is that there is more to farmers' decision making than political and economic trends (Schmitzberger et al., 2005), and that the common assumption that financial constraints ultimately determine behavior have been contradicted (Chouinard, Paterson, Wandschneider, & Ohler, 2008).

What studies do suggest, is that attitudinal variables may have more influence in farmers' decision making than money (Battershill & Gilg, 1997; Sattler & Nagel, 2010) or socio-demographics (Prokopy, Floress, Klotthor-Weinkauf & Baumgart-Getz, 2008). Van Koppen (2000) observed that moral and aesthetic values motivated nature conservationists more than

values of sustainable or private resource use. Burton (2004) supposed that the farmer's identification with a commitment to productivity may have far greater implications than the actual economics or even aesthetics of commercial agriculture, both of which remain superficial in comparison. These findings suggest that there may be much to be learned about farmers' decision making from studying concepts that underlie more transitory preferences and attitudes, such as where their cultural understandings, values, worldviews, and identities lie with regard to their land or nature.

Thus far, approaches to conservation and land management have been linked with a number of conceptual factors pertaining to how people conceive of and relate to nature. These include values (Jepson & Canney, 2003; Darnhofer et al., 2005), place attachment (Farmer, Knapp, Meretsky, Chancellor, & Fischer, 2011; Davenport & Anderson, 2005; Lokocz et al., 2011), and social representations, or understandings of nature (Buijs et al., 2008; Duram, 2000). For example, images of nature have been thought to have extensive impacts on a landscape through social practices such as natural resource management, regardless of whether those images are reflective of reality (van Koppen, 1997). Similarly, connectedness with nature has been found to inform individuals' concern for nature (Schultz, 2000; 2002). All of these concepts share a common theme of how people relate to nature. In other words, the literature points to human-nature relationships as being relevant to conservation and land management.

RESEARCH OBJECTIVES

This thesis research sets out to explore the possible linkage between human-nature relationships and conservation amongst farmers of east-central Illinois. The region has been identified as the leading contributor to the hypoxic zone in the Gulf of Mexico (Alexander et al., 1995; David et al., 2010), and the study area is a hotspot for nitrogen leaching (Royer, David &

Gentry, 2006). Studies have suggested that a social science-based approach and more integrative forms of management are necessary in order to adequately address the complexities of the nitrogen challenge. Here, a mixed-methods approach is used to gain a better understanding of the human-nature relationships of farmers, the endpoint actors in the application of artificial fertilizers. Further, this research asks the question, to what extent do farmers consider their philosophical relationship with nature as having implications on their practices? Survey and interview data collected from farm operators and landowners form the empirical basis for this analysis. Specifically, the objectives of the study are:

1. To build upon the existing conceptual framework on human-nature relationships.
2. To apply the framework to farmers' nutrient management on their lands in east-central Illinois.
3. To understand the extent to which farmers consider their philosophical relationship with nature in their farming practices.

This introduction establishes the context of the thesis research - the compounding effects of excessive fertilizer application in Illinois. It also posits human-nature relationships as a possible window through which managers charged with the remediation of this issue might gain insight to facilitate their policy or communication approaches. The following chapter explores literature on the concept of human-nature relationships and farming decision making. Chapter 2 concludes with a conceptual framework for the empirical study, which adds a new typological approach to past studies. Chapter 3 describes more specifically the data collection and methodological approach and steps taken in this research. Chapter 4 reports and interprets survey results, Chapter 5 reports and interprets the interview findings, and Chapter 6 concludes with a reflective interpretation of the findings and discusses possible directions for future research.

CHAPTER 2

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

This chapter reviews existing literature on human-nature relationships and develops a conceptual framework that guides the empirical component of this thesis. Preexisting work on the topic provides the basis for a novel typological framework and points to added considerations of the nuanced qualities of human-nature relationships. Studies of farming populations form a groundwork from which farmers' relationships with nature are interpreted. The literature review further leads to the four hypotheses of this study.

HUMAN-NATURE RELATIONSHIPS

Human-nature relationships are the ways in which people relate to nature, or "views that people hold about their appropriate relation with nature" (van den Born, 2008, p.87). This overlaps with, but is distinct from a number of interrelated concepts, such as attitudes, worldviews, and values. An attitude is an evaluative judgment (Schultz, Schrier, Tabanico, & Khazian, 2004). A worldview is a broader belief system that underlies attitudes. Values, or "important life goals or principles" such as "equality" and "wisdom" are yet deeper and provide an organizational basis for attitudes and worldviews. (Schultz et al., 2004, p.31). Other frameworks of cognitive hierarchy include value orientations, which give meaning to values in a certain context (Teel & Manfredo, 2010) and are comparable to worldviews in that they are organized around values. Each of these can be applied to concepts regarding nature (i.e. environmental attitude, environmental worldview, environmental values), and at their nexus is the theme of how people conceptually relate themselves to nature. In some cases, different terms are used to refer to human-nature relationship. Examples include ecological worldview as "a person's belief about humanity's relationships with nature" (Schultz et al., 2004, p.31), and value

orientations as "networks of beliefs that organize around values and provide contextual meaning to those values" (Teel & Manfredo, 2010, p. 129) in the context of nature. Studies of these concepts found that relationship with nature was more stable across time and less influenced by memories and day-to-day experiences than attitudes (Schultz et al., 2004; Teel & Manfredo 2010). Hierarchical models of cognition suggest that changes in trans-situational, deeply seated concepts may induce widespread change in attitudes and behavior (Grube, Mayton, & Ball-Rokreach, 1994). A more extensive review of empirical studies on how people relate to nature can be found elsewhere (Flint et al., unpublished manuscript).

Typologies of human-nature relationships

A number of attempts have been made to classify concepts of how humans relate to nature. Most often, the classification has been based on a dichotomy between environmentally conscious ecocentrism and human focused anthropocentrism. First published in 1978, the New Environmental Paradigm (NEP) and Dominant Social Paradigm (DSP), (Dunlap, van Liere, Mertig, & Jones, 2000) have so far been the most prevalent measures of environmental worldviews. Additionally, Beus and Dunlap's (1990) Alternative vs. Conventional Agricultural Paradigm (ACAP) typology of farmers' worldviews includes dimensions specific to farmers' human-nature relationship. This dichotomous categorization of farmers ranges from domination and exploitation to harmony and restraint (Beus & Dunlap, 1990).

However, these dichotomies have been critiqued for their inability to capture complexities that transcend a uni-dimensional spectrum. The developers of the NEP scale themselves have concluded that people's relationships with nature embody multiple dimensions (Dunlap et al., 2000). Studies using the ACAP have found contradictory results, whereby some practitioners of conventional agriculture were found to have the alternative paradigm, and vice

versa (Abaidoo & Dickinson, 2002; Duram, 1997). There is increasing agreement that the ACAP dichotomy lacks the capacity to represent the farmers' diversity and complexity in fullness (Corselius, Simmons, and Flora, 2003; Duram, 1997, 2000; Darnhofer, Schneeberger, & Freyer, 2005; Walter, 1997). Others have also pointed to aspects of the human-nature relationship that have received little focus in relation to this dominant dichotomy (Vining, Merrick, & Price, 2008; Daugstad, Svarstad, & Vistad, 2006), as well as to the variations within ecocentrism that is shrouded in a binary scale (van den Born, 2006).

Visions of Nature

A literature review of empirical studies on human-nature relationships revealed that a Dutch working group (hereafter: Visions of Nature group) has worked most extensively on developing an empirical typology of how people relate to nature. In their terminology, *visions of nature* have three components: *values of nature*, *images of nature*, and *image of relationship* (van den Born, Lenders, W. de Groot, & Huijsman, 2001). The third component, or image of relationship between humans and nature, is equivalent to human-nature relationship. This three-part conceptualization demonstrates the proximity as well as distinctiveness of human-nature relationships from other, closely related cognitive concepts.

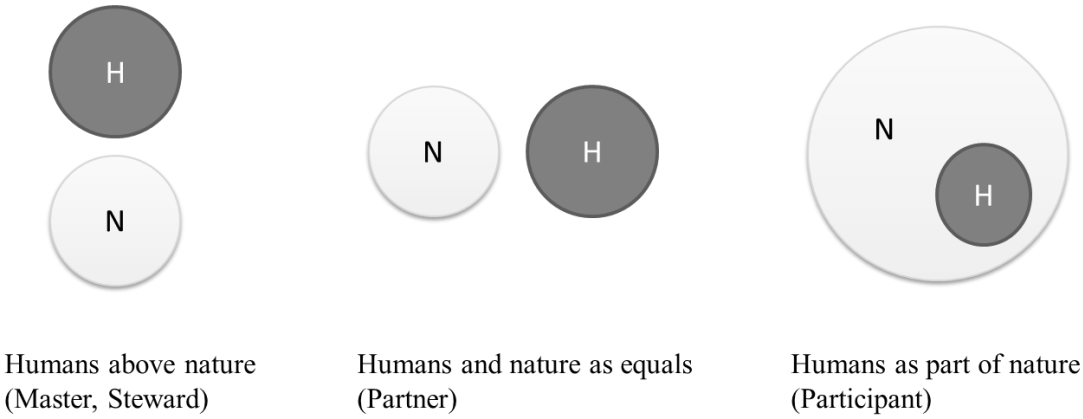
The operating relationship typology used by this Visions of Nature group was derived from philosophical literature and has evolved over time (van den Born, 2006). Unlike the dichotomous typologies of anthropocentrism, utilitarianism, and mastery over nature on the one hand and ecocentrism, non-utilitarianism, and unity with nature on the other (Dunlap et al., 2000; Xu & Bengston, 1997), the number of classified types of relationships in the Visions of Nature typology has varied from three to eight (W. de Groot, 1992). However, much of this variation is centered around four basic types employed by the most recent publications (M. de Groot, 2012).

With regard to the traditional dichotomy, these can be listed from anthropocentric to ecocentric as: Master, Steward, Partner, and Participant, with all but the first being variations within the broader realm of ecocentrism (Figure 1).

Figure 1. Typology of Visions of Nature types along the anthropocentric-ecocentric spectrum

The descriptions that follow capture core characteristics of the four basic relationship types most clearly outlined by the Visions of Nature group (W. de Groot, 1992). In the *Master* type, humans are seen to stand above nature (Figure 2) and assume a right to utilize nature for humans' benefit. This type has also been labeled "despot" and is associated with industrialization and reliance of technology sparked by Western Enlightenment. It is described as embodying a sense of opposition with a nature that must be controlled. The *Steward,* or "Guardian," also perceives humans as separate from and hierarchically above nature. This concept originated from the biblical view of humans as the western God's caretaker of nature, but has been extended to a secular sense of responsibility for future generations. The *Partner* is equal to nature in power and importance. This relationship type is characterized by a sense of collaboration and mutual benefitting in the relationship between humans and nature. Finally, the *Participant* considers him/herself part of nature. This type also includes the "nature mystic" from previous typologies, the epitome of spiritual oneness with nature and a view of humans as subordinate to nature (Zweers, 2000).

Figure 2. The positionality of humans and nature (modified from van den Born, 2008)



Humans above nature (Master, Steward) | Humans and nature as equals (Partner) | Humans as part of nature (Participant)

Apathy

In addition to the concerted research effort by the Visions of Nature group, a number of studies have proposed typologies with concepts absent from Visions of Nature. Thompson and Barton (1994) added Apathy to the anthropocentric/ecocentric spectrum. This notion of a lack of relationship with nature is also present elsewhere. Examples are "neutralistic" in Kellert's original typology of values of nature (1980), "distanced" individuals in Teel and Manfredo's (2010) measure of wildlife value orientations, "ignored" in Mievill-Ott (2002, as cited in Schmitzberger et al., 2005), and the detached "nature-sympathizer" type (Bauer, Wallner & Hunziker, 2009). Thus, the Apathy type expands the typology to accommodate the potential absence of a relationship with nature.

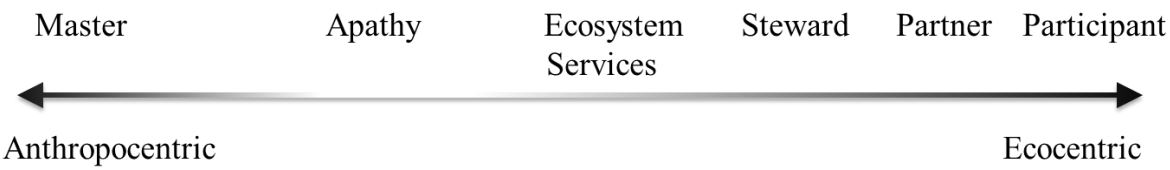
Ecosystem Services

More recently, another study addressed the concept of Ecosystem Services as a possible form of human-nature relationship (Flint et al., unpublished manuscript). A framework dominant in today's dialogue on the natural environment, Ecosystem Services is based on the understanding of nature as a "service provider" for human beings. Despite critiques about the focus on the monetization of nature's benefits to human well-being (McCauley, 2006), the

Ecosystem Services concept was formulated with the intent to facilitate the conservation of natural resources (Millennium Ecosystem Assessment [MEA], 2005; Daily 1997). As an addition to the existing typology, Ecosystem Services acknowledges the relationship type prevalent in nature management discourses.

A new typology

Figure 3. Typology of relationship types along the anthropocentric-ecocentric spectrum



Based on the literature review, this study employs a novel typology of six relationship types (Figure 3). The Master, Steward, Partner and Participant types from the Visions of Nature group (W. de Groot, 1992) were combined with the Apathy (Thomas & Barton, 1994) and Ecosystem Services (Flint et al., unpublished manuscript) concepts which were found elsewhere in the literature. The following statements summarize the resulting typology.

Master: People stand above nature and can change nature to provide for our needs and protect us from hazards.

Steward: I have a moral obligation to care for and conserve nature.

Partner: People are partners with nature, and we benefit from each other.

Participant: I am part of nature and have a strong physical and spiritual bond with nature.

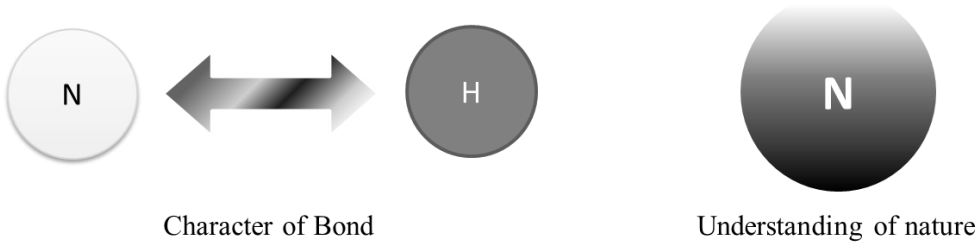
Apathy: I do not think much about nature in my daily life.

ES: My well-being depends on benefits from a well-functioning environment.

Dimensions

Human-nature relationships can be further organized by three dimensions underlying the typological approach. These dimensions are referred to as positionality of humans vis a vis nature, character of the human-nature bond, and understanding of nature (Flint et al., unpublished manuscript). *Positionality* involves notions of whether humans are separate from or part of nature, superior to or inferior to nature, and anthropocentrism-ecocentrism, i.e. whether humans or nature is considered more important in the relationship (Figure 2). *Character of Bond* addresses qualities such as the strength of the relationship, spirituality, orientations towards or away from nature (biophilia-biophobia), intensions underlying human interactions with nature, spirituality, and whether or not nature has intrinsic value (Figure 4).

Figure 4. Character of the bond and understanding of nature.



Understanding is closely associated with image of nature (e.g. fragility – resilience of nature), although only to the extent that it impacts perceived relationship between humans and nature. Rehmann-Sutter (2000) explains this connection.

> If we think that organisms are mechanistic entities, then they can only have mechanistic (functional, dysfunctional or non-functional) relationships with their environments. If we consider ourselves as parts of organic nature, then this model

> will allow only mechanistic or instrumental relationships between ourselves and the environment (p .350).

The conceptualization of the three dimensions of human-nature relationships recently emerged out of a review of existing literature (Flint et al., unpublished manuscript). This approach has not previously been used as a guiding framework for empirical work but adds to the conceptual framework guiding the empirical portion of this thesis.

Multiplicity of relationship types

Typologies of the human-nature relationship have generally been applied with the intention of categorizing individuals as adherents of one concept. However, it is increasingly believed that individuals have multiple relationships with nature that are dynamic, context-dependent, and possibly contradictory (Flint et al., unpublished manuscript). Empirical findings from the Visions of Nature group as well as other sources have shown that many people adhere to more than one concept (W. de Groot & van den Born, 2003; M. de Groot et al., 2011; Walter, 1997). For example, Teel and Manfredo (2010) created a "pluralist" type for 20% of their respondents that agreed with both of their theoretically oppositional wildlife value orientations.

Studies further suggest that an individual's perception of their relationship with nature may be physically and socially contextualized. Connectedness with nature has been known to vary for an individual depending on the kinds of nature-related activities they are engaged in (Vining, Merrick & Price 2008). Jacobs and Buijs (2011) posit that the meaning that a place holds for a person may change depending on the context. Further, studies of farmers support the identity theory, which states that individuals have multiple identities that take prominence over one another and influence their actions based on the social context (McGuire, Morton, & Cast,

2012). Other studies similarly emphasized the complexity, dynamism, subjectivity, and contextuality of the relationship between a farmer and his or her land (McGuire et al., 2012; Nowak & Cabot, 2004).

Farming is a unique context of interacting with nature, whereby land cultivation is the direct source of one's livelihood. Land management decisions must be made in a complex context and impact the farm business as well as way of life (Maloney & Paolisso, 2006). From the farmers' perspective, environmentalists, governments, and the general public do not always understand the necessary measures for production, some of which may be considered compromises in terms of natural resource management (Paolisso & Maloney, 2000). Farmers may also be highly aware of the land's productive value (Nassauer, Corry, & Dowdell, 2007; van den Berg, 1998), such that some producers would be unwilling to adopt any practice that they did not believe to be economically viable (Gassman, Tisl, Palas, Fields, Isenhart, Schiling et al., 2010). At the same time, when assuming no change in income, many farmers indicated a preference for landscapes prioritizing long-term stewardship even if it required a change in their own practices (Nassauer, Corry, & Dowdell, 2007). Thus, the immediacy of the contact with their land may attune farmers to the dependence of their present and future livelihood on their proper land stewardship (Paolisso & Maloney, 2000).

In such a manner, farmers' decision making is based upon multiple, possibly conflicting values such as productivity or economic profitability, community viability, and environmental well-being at personal and societal levels (Abaidoo & Dickinson 2002; Peterson, 1991; Buttel, Gillespie Jr., Larson III, & Harris, 1981; Herndl et al., 2011). Their relationship with the land is further complicated by its subjectivity and dynamism based on biophysical and structural conditions (Nowak & Cabot, 2004). It may not be a surprise that farmers' perspectives have been

observed to range widely, from stewardship interests to domination over natural forces (Peterson, 1991). **Hypothesis 1: Respondents are expected to agree with multiple relationship types.**

THE DISTRIBUTION OF RELATIONSHIP TYPES

This section overviews the overall representation of relationship types found in past studies. Most studies employing the typological framework have worked with the general public in various countries and communities and show some consistency in their findings. However, studies on farming populations indicate that farmers may relate to nature in different ways, and the demographic and cultural variations observed in human-nature relationships support this possibility. Past responses of general public samples to each of the six types are reviewed and compared with corresponding interpretations of studies on farming communities.

Demographic & cultural variations

Many scholars on human-nature relationships and similar concepts convey the need to understand and to address the range of variants in order to make effective management or communication approaches (Teel & Manfredo, 2009). Occupational, cultural, and contextual variations in related concepts such as social representations of nature and in management preferences have been observed (Buijs et al., 2008). Such variations may in part be linked to the observed importance of a certain locality to a person's concept of nature. Identification and relatedness with nature may be characterized by feelings of home, cultural identity, and emotional identity (Berghöfer, Rozzi & Jax, 2008).

Indeed, studies by the Visions of Nature group have found associations between demographic and cultural characteristics and how people relate to nature. For example, along the Waal river of the Netherlands, older men were found to be more likely to agree with the Master

concept (M. de Groot & W. de Groot, 2009), and Turkish and Moroccan immigrants were more anthropocentric and preferred higher levels of nature management than native Dutch citizens (Buijs, Elands, & Langers, 2009). Variations were found amongst three neighboring countries in Europe (M. de Groot, 2012). Further, a small sample of informants from four religious backgrounds indicated distinguishable tendencies in their relationship with nature (M. de Groot & van den Born, 2007). Christians and Muslims agreed most with the Steward concept, while Native Americans rejected the implied a separation from nature and its dependence on humans. The Master concept was unanimously rejected in this study, and few agreed with the implied independence of humans and nature in the Partner concept. All respondents in this study embraced the idea of being part of nature, and Native American and Buddhist interviewees most strongly identified with the Participant concept.

Moreover, engagement in a landscape strongly influences perceptions of it, and landscape preferences have shifted from functional, agricultural landscapes to more hedonistic landscapes such as of Arcadia or wilderness (Buijs, Pedroli & Luginbühl, 2006). The general public has become more removed from functional landscapes, and their adherence with the ecocentric concepts are speculated to stem out of a new longing and concern for nature in the face of rapid urbanization (W. de Groot & van den Born, 2003). Meanwhile, farmers continue to work the land and may not have followed such trends. In one study, farmers tended to disagree with the general preference for natural areas and favored landscapes showing human influence (Buijs et al., 2006). The finding that the anthropocentric value orientation was associated with preference for farm environments further confirms this possibility (Kaltenborn & Bjerke, 2002).

These prior findings on geographic and cultural variations in human-nature relationships lead to the second hypothesis of this study. Previous Visions of Nature studies have

predominantly focused on the general public in Europe and are geographically and culturally concentrated around the Netherlands (van den Born, 2006; 2007; de Groot & W. de Groot, 2009). The agricultural atmosphere in the Netherlands is such that many farmers partake in the "Arcadian" tradition, characterized by the appreciation of intrinsic value and beauty in nature and a sense responsibility to protect nature (van Koppen, 2000). Many Dutch farmers are members in conservation organizations and that make both paid and unpaid initiatives to protect their environment. While this may not be a direct indication of their personal relationship with nature, it is certainly conceivable that a study of farmers in a landscape focused on high-input, industrial production may find different tendencies in their relationship with nature. Thus, the human-nature relationships of the Corn Belt farmers sampled in this study are hypothesized to contradict past patterns of relationship types, as reviewed below. **Hypothesis 2: Human-nature relationships of Midwest farmers are expected to differ from those of the general populations in Europe studied previously.**

Review of findings on the typology

None of the literature reviewed applied the aforementioned typologies of human-nature relationships in an empirical study of farmers. However, previous studies of farming populations do shed some insight on their relationship with nature. The following section details the second hypothesis by comparing the general pattern of relationship types in past studies of the general public with interpreted findings on farming populations for each of the six relationship types.

Master

In the past studies of the Visions of Nature group, the Master type has been rejected so consistently (van den Born & W. de Groot, 2009; Hunka, W. de Groot, & Biela, 2009) that it is said that "Mastery over nature has all but disappeared as anything desirable in the minds of most

people in Western societies" (M. de Groot et al., 2011, p.39). However, the structure of agriculture in the US has maximized productivity through technologies that transform nature (Gasteyer, 2008). Land alteration is often perceived as improvement, and land management of the 19th and 20th centuries may be described as being driven by a "slash-and-burn mentality" (Turner, Rabalais, Scavia & McIsaac, 2007). In the UK, where the emphasis is similarly placed on production (Burton, 2004) and only 8% of grain farmers identified as "conservationist" (Burton & Wilson, 2006), farmers understand a "good farmer" to be one whose fields are productive and neat (Burton, 2004). Such emphasis on orderliness implies an understanding that good farmers are those who are in control of their land.

Indeed, studies report the predominance of productivity in US farmers' identity (Herndl et al., 2011). Despite contradictory findings (Chouinard et al., 2008), the overarching assumption of farmers' decision making remains that economic concerns come first and before environmental concerns (Buttel et al., 1981; Darnhofer et al., 2005; Herndl et al., 2011). Social and environmental values may be subdued as private "feelings" (Herndl et al., 2011). Peterson (1991) describes farmers as:

> *…civilization's loyal caretakers*, or those who provide the essentials required for society's continuation. They described themselves as locked in *battle* against evil forces, ranging from droughts to government regulations and demanding consumers. Technology provided the weapons needed to win the battle and preserve civilization, but civilization itself had joined with its caretakers' "natural enemies" to restrict farmers' control over their tools. (p.293)

This excerpt not only depicts the aforementioned dilemma of simultaneous demands for production and stewardship, but also a context highly conducive to the Master concept. Technological development is depicted as instrumental in overcoming obstacles such as drought, and the farmer's role in nature may be interpreted as one to exert control; it is upon their shoulders to provide for society by subduing the unruly forces of nature. Furthermore, the hostility of the context portrayed here presses down upon the farmer, who may be further inclined to transfer this pressure upon the land. These complexities of a farmers' role lead to the expectation that this study's sample revokes the unanimous rejection of the Master type by previous studies by the Visions of Nature group. At least some of the respondents in the heavily industrialized landscape of Illinois are hypothesized to agree with the Master concept.

Participant

One of the concepts that were found to resonate most with samples in prior studies is the Participant notion of humans being "part of" nature (van den Born et al. 2001). A study of Illinois residents also found that respondents considered themselves part of nature (Vining et al., 2008). However, in farming communities, the Participant concept has been regarded negatively. In Iowa, farmers associated terms such as "sustainability" and "environmental" with outsiders criticizing their longstanding practices and holding political agendas of environmental regulations counter to the farming community's economic interests (Herndl et al., 2011). Those outsiders were referred to as "tree huggers," "greenies," and "rabble-rousers," and farmers distanced themselves from such terms. Such aversion towards explicit remarks of ecocentrism leads to the expectation that few Illinois farmers identify with the most ecocentric, Participant concept.

There is, however, one factor that may work against such aversion towards the concept of humans being part of, and subordinate to nature. Farmer's intimacy and reliance on nature also makes them vulnerable to its capriciousness. Chesapeake Bay farmers expressed their perception of nature as something unpredictable and that cannot be fully known, understood, or controlled (Paolisso & Maloney, 2000). In this aspect, farmers may see nature as more powerful than a scientist, or an urban dweller may, steering them towards the Participant type to some extent.

Steward

Findings from empirical studies found the Stewardship concept to be one of the prevalent relationship types amongst the general public (M. de Groot, 2012; M. de Groot & van den Born, 2007). Studies also indicate the potential prevalence of this concept in farming communities. Farmers' ideals of doing "what's best" and not detrimental to their land, for their own sake as well as neighbors' (Herndl et al., 2011; Paolisso & Maloney, 2000), are aligned with the Steward type. For example, Walter (1997) found the highest levels of agreement with the vision of a successful farmer as a Steward, one that saw the up keeping of land resources as a moral responsibility. The concept of "Stewardship" has come up in past studies as a term of self-identification. Chesapeake Bay farmers (Paolisso & Maloney, 2000) and Iowa farmers (Herndl et al., 2011) both preferred this term over others expressing environmental concern.

Indeed, farmers' motivations in land management have been remarkably in line with the Steward concept. Often, their concern is for future generations (Herndl et al., 2011). Many have made their religious grounds for caretaking explicit (Corselius et al., 2003), agreeing with the initial, religious connotations of the Steward type: "Well, we're put here on this earth to take care of it, to make a living, enjoy it, but to take care of it for future generations. And ethically, we would never do anything that would destroy the land" (Herndl et al., p. 453).Thus, these remarks

in farmers of past studies about ethical and religious bases for their sense of responsibility to steward their land, suggest that this concept characterizes general populations and farming communities alike.

Partner

Past studies do not report a clear trend in the acceptance of the Partner concept. In the Visions of Nature studies, assessments of the Partner type have had mixed findings (M. de Groot, 2012) and was less adhered to by general population samples than the Stewardship and Participant types (van den Born 2008). Farmers from Maryland's Chesapeake Bay area expressed some notions of this concept in Paolisso and Maloney's (2000) study. Many personalized their land, much like a homeowner who sees their backyard as an extension of their home and family. Further, the researchers observed that the farmers "believe they are 'real' environmentalists because they live with nature every day and depend on it to make a living" (Paolisso & Maloney, 2000, p. 214). Their idea that this intimate relationship with their land is mutually beneficial is characteristic of the Partner concept and points to the potential adherence of farmers with this concept. Overall, while these studies do not give a strong indication, they suggest at least moderate levels of agreement with the Partner concept amongst this study's farming sample.

Apathy

The Apathy construct has been empirically tested in a number of different studies. In a study that inferred human-nature relationships from attitudinal measures, the nature-sympathizer type, expressing emotional distance from nature, was the least popular construct (18.2%). In another, of random individuals at an airport and college students, environmental apathy again had the lowest agreement (averaging 1.8 on a 5-pt Likert scale), compared to ecocentrism (4.1)

and anthropocentrism (2.8) (Thompson & Barton, 1994). Additionally, one study of wildlife value orientations measuring "traditionalist" and "mutualist" orientations much like the Master and Partner concepts found that 13% of the participants did not agree with either type and classified them as "distanced" (Teel & Manfredo, 2010). Overall, these studies report low levels of agreement with the Apathy construct in past studies of non-farming populations.

None of the reviewed literature on farmers made a direct allusion to their apathetic or non-apathetic relationship with nature. It may be difficult to imagine that farmers who are aware of the connection between their livelihood and the natural productivity of their land could be entirely distanced from nature. However, it is conceivable that some farmers may dissociate their farmland and its productive capacity from nature at large, just as Iowa farmers distanced themselves from terms such as "green" and "environmental" (Herndl et al., 2011). Furthermore, the industrial intensity of conventional farming in the US may be interpreted as a lack of concern for nature. While the Master concept may also involve a lack of environmental concern, it acknowledges a certain domineering relationship with nature. Apathy, an utter absence of the relationship itself, may be conceivable if farmers entirely dissociate their working environment or production process from their concept of "nature." Overall, past studies do not make clear indications on the representation of the Apathy concept amongst farmers, or how it may compare to prior findings from the general public.

Ecosystem Services

Ecosystem Services has so far only been theoretically proposed as a possible human-nature relationship type (Flint et al., unpublished manuscript). However, its dominance in the present environmental discourse suggests that there is widespread support of this construct in policy making contexts. As a concept, Ecosystem Services attempts to encompass all facets of

the benefits humans receive from nature by incorporating both biophysical as well as cultural components (MEA, 2003). In a study of the Swiss public, "nature-connected users" that value nature in utilitarian ways comprised 27.3% of the sample (Bauer et al., 2009). This may loosely hint at the potential popularity of Ecosystem Services as a human-nature relationship concept. The "user" roughly embodies the benefit-receiving role of humans, and while Ecosystem Services does not require emotional proximity with nature characteristic of the "nature-connected user," the concept does formally attempt to acknowledge the non-tangible benefits (MEA, 2003; Chan, Satterfield & Goldstein, 2012).

The immediate dependence on the land that likely distinguishes farmers' relationships with nature from other populations' may also be understood in terms of ecosystem services. To farmers, the benefits of ecosystems that the Ecosystem Services concept was designed to capture (Gómez-Baggethun & R. de Groot, 2010) are likely more tangible. The balancing act between productivity and ecological integrity may further bring an Ecosystem Services-oriented mindset to the forefront of their minds. Indeed, Herndl et al. (2011) noted members in the Iowa farm community rationalized their environmental practices through profitability and recommended that those interested in promoting conservation practices may weaken tensions by focusing on the intersection of economic and environmental values. Overall, past studies point towards high levels of agreement with the Ecosystem Services concept amongst farmers.

HUMAN-NATURE RELATIONSHIPS AND CONSERVATION

Few studies have focused specifically on how people relate to nature with respect to conservation practices. However, scholars have reported on the potential relevance of human-nature relationships to conservation practices. White (1967) and Schroeder (2007) each wrote that how people act with regard to nature depends on their relationship with nature. The "western"

tradition of dominating and conquering nature has been coined as permitting exploitation (White, 1967; Scherer & Attig, 1983; Simaika & Samway, 2010), and as the foundation of today's environmental problems (Catton & Dunlap, 1978). The Visions of Nature group has been reporting findings that Western Europe had now moved "beyond" this mindset (M. de Groot, 2012, p.8), and that at least in the Netherlands, this shift in how people relate to nature has coincided with a general trend in policies, from working against nature to working with nature (M. de Groot & W. de Groot, 2009). Regarding farmers, farming styles classified based on economic, social, and attitudinal variables were found to impact the environment differently (Schmitzberger et al., 2005). This section reviews empirical findings that give some indication of the linkages between the relationship types and conservation.

Fischer and Young's (2007) study elucidates the potential link between human-nature relationship and conservation while also demonstrating how individuals that engage with the natural environment in different ways may view and relate to it in distinct ways. In their study, students of agriculture showed distinct relationships with nature and land management preferences from mountaineers and birdwatchers, tourists, and foresters. More specifically, agriculture students and foresters saw humans as the manager of nature, tourists tended to see humans as users of nature, and mountaineers and birdwatchers saw humans as separate from nature, seen as fragile. Perhaps not surprisingly, agriculture students and foresters preferred a hands-on approach to land management, while mountaineers and birdwatchers supported human-exclusive areas (Fischer & Young, 2007). Thus, the study depicts an interrelatedness of engagement with nature, relationship with nature, and nature management preferences. While it grouped all students of agriculture as one, a more in-depth study of farmers may uncover

variations within the farming population, as well as linkages between human-nature relationship types and approaches to conservation.

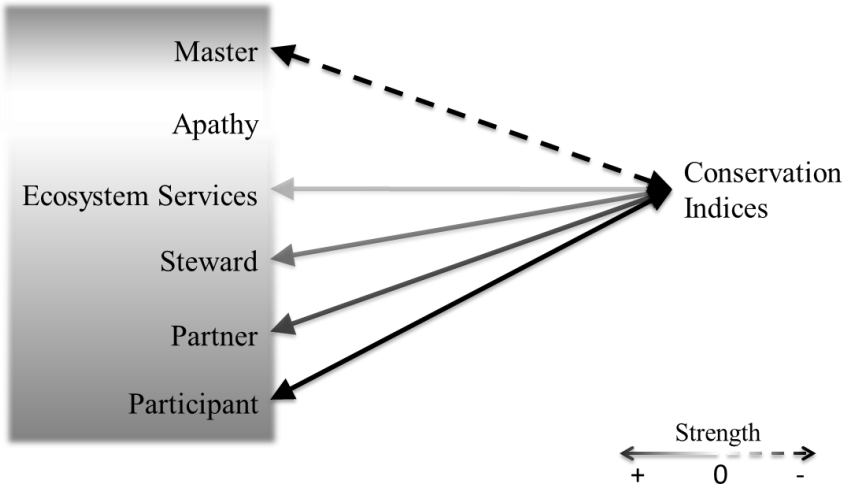
Landscape preferences may represent one's understanding of nature, one of the three dimensions of the relationship introduced in the previous section. Furthermore, images of nature, or how nature ought to look like, may legitimize how nature is handled (Rehmann-Sutter, 2000; Buijs et al., 2008). Wouter de Groot and van den Born (2003) found that the Master concept, embodied in their Adventurer and Exploiter types, was associated with preferences for man-made and park-like landscapes and a rejection of a wilderness landscape. The ecocentric concepts had the inverse tendencies, preferring wild landscapes with "greatness and forces" (W. de Groot & van den Born, 2003). This is largely consistent with Kaltenborn and Bjerke's study (2002) which found that ecocentric value orientations were associated with a preference for wild landscapes though also for cultural landscapes, and that anthropocentric value orientations were associated with a preference for farm environments. Individuals who were apathetic about nature generally disliked cultural and wild landscapes. In both studies, preferred landscapes of participants leaning towards anthropocentrism exhibit evidence of human influence, while as those with ecocentric leanings tended to prefer pristine landscapes. These tendencies may play a role in the conservation practices that farmers with the respective orientations prefer or engage in.

Findings on relationship types and land management preferences are broadly consistent with the landscape preferences. In a Dutch study on river management preferences, Stewards generally opposed cutting trees (M. de Groot & W. de Groot, 2009) and preferred the relocation of dikes, considered more sustainable albeit requiring the removal or adaptation of residences (M. de Groot, 2012). Masters were more likely to favor dike reinforcement. This is consistent with Teel and Manfredo's (2010) finding that *mutualists*, who saw wildlife in terms of companionship,

were more likely to prefer management approaches that prioritized wildlife protection over human interests than *traditionalists*, who viewed wildlife in utilitarian terms. Again, anthropocentric relationships were associated with a focus on human interests, while the more ecocentric constructs associated with a prioritization of ecological concerns.

Thus, the literature suggests a third hypothesis of this study: conservation practices are expected to be positively correlated with agreement on the ecocentric concepts of Participant, Partner, Steward, and Ecosystem Services and negatively correlated with agreement on the Master concept (Figure 5). This hypothesis draws on the general idea of ecocentrism and anthropocentrism, and that the farmers who act on the anthropocentric concept of Master will have little or less regard for nature's intrinsic integrity. This does not preclude the possible caretaking based on the understanding that the ecological functions of the farmland impact humans, as captured by the Ecosystem Service concept. However, according to the theory, anthropocentric motivations inherently contrast with more ecocentric concepts. Broadly speaking, farmers who identify with ecocentric concepts are expected to care about the ecological integrity of their land for its own sake, regardless of impact on yields or on human life quality. This more directed concern implicit in ecocentric concepts lead to the hypothesis that ecocentrism would be positively associated with an orientation towards conservation practices. **Hypothesis 3: Conservation interests among farmers are expected to be positively related to ecocentric tendencies and negatively with anthropocentric tendencies. The relative strengths of associations between relationship types and conservation are expected to parallel the typology's spectrum from ecocentrism to anthropocentrism, with the most ecocentric type expected to have the strongest association.**

Figure 5. Hypothesized associations between relationship types and conservation indices



To detail this third hypothesis, the strength of correlations between the conservation indices and Visions of Nature types are hypothesized to parallel the progression from eco- to anthropocentrism (Zweers, 2000): Participant, Partner, Steward, and Master. Agreement with the Master type is expected to correlate negatively with a conservation orientation, at opposite ends of the spectrum with expected agreement with the Participant, anticipated to have the strongest positive correlation with the intention or practice of conservation. For respondents who are generally apathetic about nature, their relationship with nature is expected to have little influence on their conservation practices or intent. Thus, the correlation is hypothesized to be insignificant or obscured by other influences such as financial considerations.

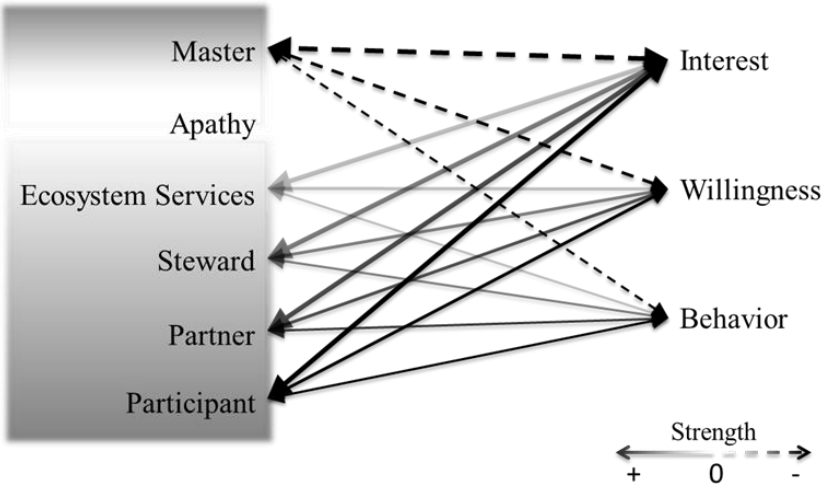
CONSERVATION ATTITUDE AND PRACTICE

The adoption of conservation practices is a gradual process (Nowak & Korsching, 1998). Attitudinal measures may therefore be a more accurate and reliable indicator of potential for future conservation practices than current engagement in conservation. A plethora of alternative factors such as the accessibility of a practice mediate the linkage between attitudes and action (Azjen, 1991). On farms, studies have pointed to economic viability (Gassman et al., 2010), lack

of time (Schmitzberger et al., 2005), sociopolitical structure and past experiences (Jacobs & Buijs, 2011) as major influencers of engagement in conservation practices. This complexity of decision making may render abstract cognitions such as human-nature relationships weak predictors of behavior (Ajzen, 2005; Schultz, Gouveira, Cameron, Tankha & Schmuck, 2005). Rather, relationship with nature may feed more specific cognitions, such as attitude or interest that lead to behavior (Jacobs & Buijs, 2011).

Accordingly, the final hypothesis of this study is that human-nature relationships have a closer connection with interest and intention than with actual behaviors (Figure 6). Given the tenuous attitude – behavior link reported for abstract cognitions such as relationship with nature and behavior (Ajzen, 2005; Schultz et al., 2005), an alternative hypothesis would be that the link between human-nature relationships and even attitudinal measures regarding conservation practices would be conditioned by external factors such as financial constraints. **Hypothesis 4: Human-nature relationships are expected to be most closely associated with interest in conservation, followed by willingness to adopt practices and then behavior.**

Figure 6. Hypothesized associations between relationship types and conservation interest, willingness, and behavior



STUDY CONTEXT

This study focused on human-nature relationships as they relate to agricultural practices amongst farm operators in the Embarras watershed of east-central Illinois. East-central Illinois is part of the Upper Mississippi River Basin, known for decades as one of the primary contributors of nitrogen to the Gulf of Mexico (Alexander et al., 1995; David et al., 2010). High intensity row cropping and drainage modifications in this area that utilize an underground network of tiles are representative of the upper Midwest region and primary causes of nitrate leaching (Royer et al., 2006; Dinnes , Karlen, Jaynes, Kaspar, Hatfield et al., 2002). The Embarras watershed is reported to have some of the highest nitrogen losses within the Mississippi Basin (Royer et al., 2006).

In terms of nutrient management, current agricultural practices in this region are "very inefficient," whereby much of the fertilizer is not taken up by corn but is leached out into water resources (Dinnes et al., 2002, p. 155). Nationally, only 35% of croplands meet current standards of nitrogen management (Ribaudo, 2011), suggesting even lower rates of compliance in areas of concentrated nitrogen leaching. This is despite decades of policy measures attempting to remediate the issue (Peterson, 1991), and the recommended reduction of nitrogen inputs by at least 45% in order to reduce the hypoxic zone (EPA SAB, 2007).

This study utilizes survey and interview methodology to better understand farm operators in the Embarras Watershed through their relationship with nature. These farm operators are the final actors in the use of nitrogen fertilizers and mitigation of their leaching into surface waters. This point of input in areas of the highest loadings promises the most potential for remediation (Schipper et al., 2010; Cho, Vellidis, Bosch, Lowrance & Strickland, 2010), and while farmers have been feeling the pressure and blame (Paolisso & Maloney, 2000), the recognition has thus

far been insufficient in instigating positive changes in water quality conservation. As federal research efforts have yet to combine social and ecological approaches (Hufnagl-Eichiner et al., 2011), it is hoped that studying the human-nature relationships of farm operators as it relates to their conservation practices might shed useful insight for future policy

SUMMARY

Despite the existing literature, researchers of human-nature relationships view the concept to be underexplored (M. de Groot & W. de Groot, 2009). While the Visions of Nature group has made much progress in synthesizing and elaborating on preexisting works, the conceptual framework is still undergoing development, with relationship concepts that have yet to be addressed. Applied use of human-nature relationship typologies to understand conservation and with farmers is yet to be seen, and geographic and cultural variations remain relatively unexplored. In particular, little is known about farmers' perceptions of their role on their land and how they negotiate trade-offs between profits and conservation (McGuire et al., 2012; Chouinard et al., 2008; National Research Council [NRC], 2010). Particularly in this context abound with uncertainty and a plethora of decision making factors, farmers' relationships with nature and their link to their engagement and attitudes towards conservation may provide valuable information for future efforts in conservation (van den Berg, 1999).

The conceptual framework in this study presents a novel typology of human-nature relationships. Apathy (Thomas & Barton, 1994) and the newly proposed Ecosystem Services constructs (Flint et al., unpublished manuscript) are combined with the four Visions of Nature constructs of Master, Steward, Partner and Participant (W. de Groot, 1992). The relationship dimensions of positionality, character of bond, and understanding of nature (Flint et al., unpublished manuscript) further expands the typology to encompass the subtleties of how people

relate to nature. This framework builds upon previous research efforts by combining various aspects of preexisting work. The empirical portion of the study utilizes this framework to test four major hypotheses:

1. Respondents are expected to agree with multiple relationship types.
2. Human-nature relationships of farmers are expected to differ from that of the general populations studied previously.
3. Conservation interests among farmers are expected to be positively related to ecocentric tendencies and negatively with anthropocentric tendencies. The relative strengths of associations between relationship types and conservation are expected to parallel the typology's spectrum from ecocentrism to anthropocentrism, with the most ecocentric type expected to have the strongest association.
4. Human-nature relationships are expected to be most closely associated with interest in conservation, followed by willingness to adopt practices and then behavior.

CHAPTER 3

METHODOLOGY

This study was designed to explore farmers' relationship with nature and possible linkages with conservation and adoption of practices for addressing water quality issues caused by nutrient loading. Survey data were used to assess the hypotheses outlined in the previous chapter regarding human-nature relationships and their association with measures of water quality conservation. Interview transcripts were used to verify and add depth to these findings, while allowing room for emergent themes. This chapter reviews the justification for this mixed-methods approach, provides an overview of the resulting study design, and describes data collection and analytical methodologies.

A combination of quantitative and qualitative approaches was used to gain more accurate and nuanced insight to the farmers' relationship with nature and conservation. This study further develops a typology of human-nature relationships, a concept that is highly subjective, personal, and may not have previously been thought about and verbalized by study participants. Moreover, human-nature relationships are gaining recognition as a dynamic and contextualized concept of co-existing types within a person (Flint et al., unpublished manuscript). The use of complementary datasets increases the likelihood that the conclusions drawn are valid indicators of the conceptual framework (Erzberger & Kelle, 2003), and the subjectivity, novelty, and dynamism of the concept all render this particularly beneficial. Standardized surveys reach a larger pool of respondents whereas interviews address subtleties of concepts often missed by surveys (Abaidoo & Dickinson, 2002) and the categorical representation of human-nature relationships (Jacobs & Buijs, 2011). Such an expanded methodology, therefore, allows for a more diversified understanding of the concept (Greene & Caracelli, 1997).

Prior studies by the Visions of Nature group utilized survey (M. de Groot et al., 2011), interview (van den Born, 2008), and mixed methodologies (Hunka et al., 2009; M. de Groot & van den Born, 2007; M. de Groot & W. de Groot, 2009). For surveys, measurements relevant to human-nature relationships prior to the development of the Human and Nature (HaN) scale by the Visions of Nature group include the New Ecological Paradigm (NEP; Dunlap & van Liere, 2000) and the Connectedness to Nature Scale (Meyer & Frantz, 2004). However, these scales were not designed to capture the full range of human-nature relationships, and the HaN scale was developed specifically to address people's relationship with nature (M. de Groot et al., 2011). The statements used in this study were developed independently of the HaN scale, but designed to address the essence of each of the four types in the HaN scale. The aim here was to build on the prior work, adding items associated with apathy and ecosystem service concepts.

Previous work by the Visions of Nature group also incorporated a mixed methodology of interviews and surveys. In many of these studies, the interviews focused on producing a qualitative understanding of the Vision of Nature, which encompasses the understanding of nature described in chapter 2 as part of the human-nature relationship. Some of these then took a quantitative approach with the interviews to investigate the relationships themselves (van den Born & W. de Groot, 2009). Some of these studies were supplemented by the HaN survey (M. de Groot & van den Born, 2007; M. de Groot & W. De Groot, 2009), or used open interviews to follow up on the survey (Hunka et al., 2009). This study replicates some of the fruitful approaches found in previous studies by utilizing a survey in combination with a semi-structured interview.

DATA COLLECTION

This study draws upon previously collected interview and survey data from a large ongoing project on nutrient management in the Embarras watershed in east-central Illinois. The mailing addresses of landowners in Champaign and Douglas counties were acquired from the respective county assessors' offices. In spring of 2012, postcards soliciting interviews were sent out to the 650 landowners of agricultural lands within the study area identified using a GIS shapefile of the Embarras watershed.

Returned postcards from 49 individuals indicated they were willing to be interviewed. Of these, 28 were interviewed, 11 could not be reached, and 10 refused to be interviewed. Each interviewee was asked if they knew of other potential interviewees in the watershed, and an additional 18 contacts were acquired through personal references, 10 of whom were interviewed. Of the resulting 38 interviews, 18 were farm operators. Two of the farm operators were retired. Fifteen owned land in the study area but did not farm, and five were employees at farm management agencies, including one interviewee who operated a farm but responded to the interview from a manager perspective.

Surveys were administered the summer of 2012 to farm operators based on a contact list supplied by the Farm Service Agency to the Champaign County Soil and Water Conservation District (CCSWCD). Contacts included anyone in the watershed enrolled in any agricultural governmental program, such as the Conservation Reserve Program (CRP), cost-share, and crop insurance programs. The CCSWCD maintained contact lists and printed labels and letters while the research team led by Dr. Courtney Flint managed surveys using identification numbers to meet Farm Service Agency (FSA) requirements.

The 12-page mail survey was administered following a modified Tailored Design Method including two waves of survey mailings and a reminder/thank you postcard (Dillman 2009). Of the 335 surveys sent out to the list from the SWCD, 113 were returned completed, 31 were returned but ineligible because the respondent did not farm inside the study area, 16 were declined, and 8 were undeliverable. The response rate after omitting the ineligible and undeliverable surveys was 38.2%. Of these 113 returned surveys, 104 had responses to at least one of the human-nature relationship statements.

Analyses of both of these datasets were conducted by the author of this thesis after data collection was complete. Procedurally, an initial analysis of the survey data informed the analysis of the qualitative data. The interviews provided explanations for the survey data and captured nuances that escaped the numbers, while providing room for exploring emergent themes.

SURVEY

Human nature-relationships and conservation

At the end of the survey, respondents were asked to indicate their agreement with human-nature relationship concepts on a 5-point Likert scale (1=*Strongly disagree*, 3=*Neither agree nor disagree*, 5=*Strongly Agree*). Six statements, one for each concept, were listed in the following order without their concept names:

Master: People stand above nature and can change nature to provide for our needs and protect us from hazards.

Apathy: I do not think much about nature in my daily life.

Partner: People are partners with nature, and we benefit from each other.

Steward: I have a moral obligation to care for and conserve nature.

Participant: I am part of nature and have a strong physical and spiritual bond with nature.

Ecosystem Services: My well-being depends on benefits from a well-functioning environment.

Recognizing that human-nature relationships may vary depending on the context or scale, the question asked respondents to indicate their agreement with each of the statements "*regarding the land you own or farm."*

Three indicators of conservation practices were used from the survey. The first was focused on conservation interest and asked, "*How interested are you in new agricultural practices for your farm for conservation?*" Responses were on a 5-point Likert scale with labels for the two endpoints (, 1=*not interested,* 5=*Very interested*).

The second variable measured willingness to adopt three relatively uncommon conservation practices (drainage water management, constructed wetlands, and bioreactors). Responses options were 1=*Yes or already do*, 2=*Maybe,* and 3=*No*. After testing for scale reliability, these responses were aggregated in a number of ways, including the final categorization of 1=*Willing to adopt one or more practices*, 2=*Maybe willing to adopt one or more practices (if not willing to adopt any),* and 3=*Not willing to adopt any of the three practices*.

The third variable was conservation behavior. The survey listed five relatively common or known conservation practices having positive implications for improving water quality due to nutrient loading: "Follow a nutrient management plan," "Conduct regular soil tests," "Follow university recommendations for fertilization rates," "Use variable rate application technology,"

and “Use winter cover crops.” The number of items that respondents indicated they currently use was summed as an index variable of conservation behavior.

Quantitative Analysis

The survey approach enables a direct and quantitative test of the four hypotheses laid out in chapter 2. The analytical protocols used to assess each of the hypotheses are outlined below. The first hypothesis that respondents would agree with multiple relationship types, is addressed by examining the distribution and number of agreement with the respective types. Further, an examination of the relative proximity of the types to each other provides a more detailed account of the degree to which respondents’ human-nature relationships encompassed varying concepts from the typology. A factor analysis was conducted based on a polychoric correlation matrix of the six relationship items. Polychoric correlation coefficients circumvent the assumption of continuous data for correlations by assuming an underlying continuity beneath the ordinal categories and inferring the associations between variables (Ekström, 2011). The resulting factor loadings give more meaning to the assessment of respondents’ hypothesized agreement with multiple relationship types by shedding further insight on the distribution and multiplicity of the survey responses.

The second hypothesis is that Embarras farmers contradict the pattern in past studies of human-nature relationships. This is also addressed through the initial examination of the survey responses. The proportion of farmers that agreed with the relationship types can be compared with the overall pattern on the respective types in past studies to assess this hypothesis.

The third hypothesis regarding the directionality and strengths of associations between the relationship types and conservation indices was assessed through correlation coefficients and

chi square tests of independence. For the ordinal interest and practice indices, a correlation matrix reported their associations with each of the relationship types. Kendall's τ is a nonparametric correlation coefficient that generally yields lower values than Spearman's r_s and Pearson's r by 66-75% (Strahan, 1982, as cited in Field, 2009, p. 193). However, this coefficient is a more accurate estimate of the populations than Spearman's r_s, the non-parametric equivalent of Pearson's r for non-continuous variables such as these conservation indices (Field, 2009). For the categorical index for adoption inclination or willingness, the equivalent analysis used chi square tests of independence.

The relative strengths of how the three conservation indices relate to human-nature relationship types were also hypothesized. This final hypothesis was tested through a comparison of the chi square results for each of the conservation indices. Each relationship type and conservation index was entered into the chi square as a categorical variable.

INTERVIEWS

Semi-structured interviews of Embarras watershed farmers were conducted by a lab assistant as part of the broader project on nutrient management. Overall, questions were directed towards farmers' perceptions and concern regarding water quality and factors that influenced their land management decision making. The last directed question was specifically targeted at their relationship with nature: "*How would you describe your relationship with nature in general or in this landscape?"* followed by, "*Do you think this perspective influences your farming decisions?*"

Interviews lasted between 12 to 90 minutes, with the majority ranging between 20 and 50 minutes. With an exception of four of the 37 interviews where the interviewee declined to be

recorded or the equipment failed, all interviews were audio recorded and transcribed. Transcripts were coded for implied or explicit mentions of interviewees' relationship with land, and organized according to the typologies from the literature as well as emergent themes.

CHAPTER 4

SURVEY RESULTS

The following chapter reviews the quantitative analysis of the survey described in chapter 3. The first section overviews the demographic characteristics of the survey respondents. The following sections report and discuss the results addressing the hypotheses of the study.

Sample demographics

The major characteristics of the survey respondents and their operations are reviewed in this section. Where possible, demographic characteristics of the respondents are compared with 2007 statewide averages (Economic Research Service [ERS], 2013). State-wide comparison data includes farmers across a diverse set of geographic and socioeconomic contexts.

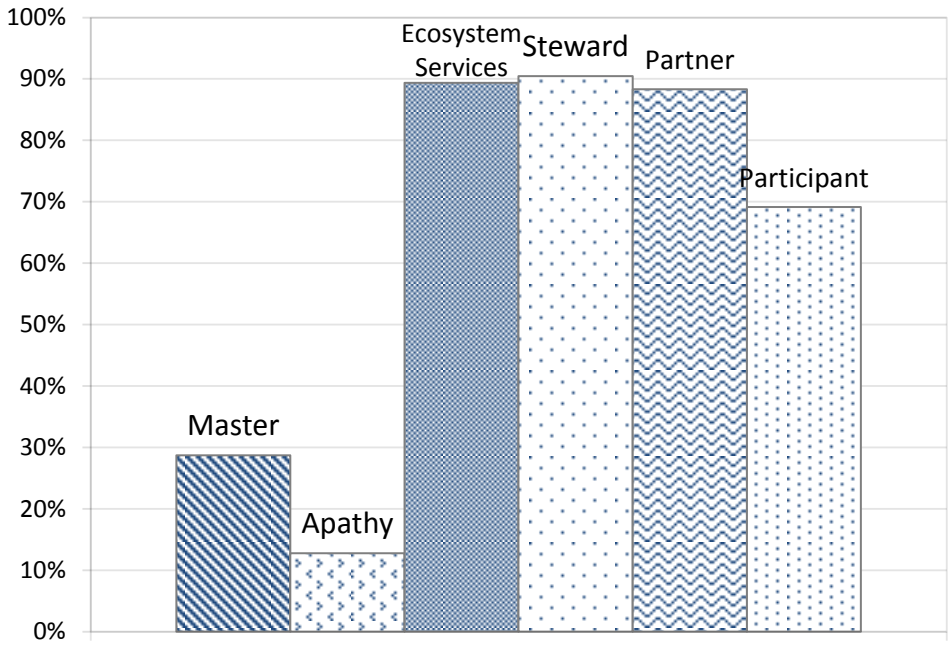
The survey respondents were overwhelmingly male-dominated (95%), consistent with the wider demographic of principle farm operators (90% male). Respondents' age was also comparable with the statewide average for principal farm operators of 56.2 years old, ranging from 28 to 97 and averaging 60 years old. The surveyed population had higher degrees of education than the 2007-2011 state average for rural areas, 74.7% having attended some college, compared to 49.3% across the state. The average farm size was 1,041 acres, substantially larger than the statewide average of 348 acres (ERS, 2013) as well as the Champaign county average of 396 acres (United States Department of Agriculture [USDA], 2007). Compared to the state's 30.3%, 74.8% of respondents earned more than $100,000 in gross farm income. Most respondents (68%) rented the majority of their land. Across the state, 41.3% of farms were tenant or part owned in 2007. This comparison of the sample demographic with statewide averages indicates considerable deviation.

Some additional characteristics of the respondents could not be verified with state averages. Sixty-one percent of respondents farmed and lived in the Embarras watershed. On average, farm sales comprised 90% of respondents' household income. On average, respondents had farmed for 37 years and had taken over the farm or its operations from a family member (82%). Over half (57%) expected a family member to succeed the operation (22% unsure, 21% unlikely). Overall, the demographic characteristics of the sample were in many ways distinct from the broader state of Illinois. While this is to be expected given the wide socioeconomic variation in the Illinois, the findings from this survey should not be over-generalized beyond the study sample.

MULTIPLICITY OF TYPES

Results clearly indicate the respondents' agreement with multiple concepts. Figure 7 shows the number of respondents who agreed (4 or 5 on a scale from 1=*strongly disagree* to 5=*strongly agree*) with the respective items. Only 5 respondents (6.4%) agreed with one statement, and 18 respondents (19.4%) agreed with both the Master and the Participant. On average, respondents agreed with 3.79 out of 6 statements. Of the four Visions of Nature concepts, respondents agreed with an average of 2.77 statements. A more detailed analysis of the correlations amongst the relationship types can be found in Appendix D.

Figure 7. Percentage of respondents that agreed with each concept



A factor analysis was conducted to further explore the relative diversity of concepts characterizing the respondents' relationship with nature. Since factor analyses assume continuous data, a polychoric correlation matrix was created to enable the procedure with the ordinal relationship variables. The procedure identified two factors with eigenvalues above Kaiser's criterion of 1. The two cumulatively explained 78.04% of the variation, with the first factor explaining 58.54%.

The results of the factor analysis indicate that the ecocentric concepts group together. As seen in the factor loadings after an orthogonal rotation to differentiate the factors (Field, 2009), Partner, Steward, Participant and Ecosystem Services have high loadings on Factor 1 (Table 1), and together have a high reliability score (Cronbach's $\alpha = 0.933$). In contrast, while Factor 2 has an eigenvalue of 1.17, the reliability is low (Cronbach's $\alpha = 0.198$), and the constructs have a

low correlation of *r*=.015 and were differentiated in other statistical tests (PCA, Wilcoxon). These results indicate the distinctness of the Master and Apathy items from each other.

Table 1. Rotated factor loadings of human-nature-relationship types

Item	Factor1	Factor2
Partner	**0.94383**	-0.06306
Steward	**0.94337**	-0.12991
ES	**0.9298**	0.12603
Participant	**0.91769**	0.04931
Master	0.07615	**0.75563**
Apathy	-0.08373	**0.754**
Eigenvalues	3.512532	1.169587
Variance explained	58.54%	19.49%
α	**0.933**	0.198
n = 103		

The hypothesized multiplicity of the respondents' human-nature relationship types was further assessed based on the results of this factor analysis. All four of the ecocentric concepts were grouped together so that there were three groupings of ecocentric, anthropocentric, and apathetic constructs. 34% of the respondents agreed with more than one grouping. With an exception of 3.2% of the respondents, all had agreed with one or more of the ecocentric items. Thus, 34% of respondents had agreed with an ecocentric concept and one or both of the Master or Apathy concepts.

High levels of agreement with multiple relationship types confirmed the first hypothesis on the multiplicity of relationship types. Not only did most survey respondents agree simultaneously with multiple statements (94.7%), over a third agreed with human-nature relationship concepts that may be considered contradictory from a theoretical standpoint (34%).

The distinctiveness of Embarras farmers' human-nature relationships from samples of past studies was assessed by a closer examination of the distribution of the agreement with the six relationship types. Most notably, 27 farmers (28.7%) agreed with the anthropocentric Master (*M*=2.88, *Mdn*= 3, *n*=103) concept, contrasting the virtual absence of this mentality in previous studies by the Visions of Nature group. This high level of agreement with the Master statement is consistent with the hypothesis that the human-nature relationships of this study's sample contrasts with prior studies.

The Participant was another concept where farmers' responses were hypothesized to diverge from that of the general population. The low level of agreement with this concept (*M*=3.79, *Mdn*= 4, *n*=103) relative to the other ecocentric statements again contradicts the overwhelming popularity of the Participant concept reported by the Visions of Nature group. Nonetheless, the majority (*n*=65, 69.1%) of respondents found the statement agreeable, and responses were negatively skewed, *D*(103) = 0.208, *p*=.000. This high level of agreement indicates that Illinois farmers may not be entirely averse to the idea of being "part of" and strongly bonded with nature on their lands.

The Steward (*M*=4.1, *Mdn*= 4, *n*=103) was a highly popular concept with a strong negative skew, *D*(103) = 0.0.292, *p*=.000, and adherence by 85 (90.4%) respondents. This was followed closely by the Ecosystem Services statement (*M*=4.11, *Mdn*= 4, *n*=103), *D*(103) = 0.273, *p*=.000, that 84 (89.4%) respondents agreed with, and the Partner statement (*M*=4.12, *Mdn*= 4, *n*=104), *D*(103) = 0.253, *p*=.000, with which 83 (88.3%) respondents agreed. Apathy (*M*=1.99, *Mdn*= 2, *n*=103) was the least popular concept, with only 12 (12.8%) in agreement (4 or 5) and close to half of respondents (*n*=49, 47.6%) strongly disagreeing (1=*strongly disagree*)

with the statement and another 24 (23.3%) disagreeing (2). This is consistent with past studies that found this concept to be unpopular and that farmers' interactions with their land were particularly intimate.

Overall, the distribution of survey responses on the human-nature relationship items confirms the hypothesized diversion of this study from the general pattern in past studies. The clearest contradiction is the agreement by 28.7% of respondents with the Master concept, which was said to be virtually nonexistent in the west European public (M. de Groot, 2012). The low level of agreement with the Participant concept (69.1%) relative to other constructs also contradicts the popularity of this type in past studies (van den Born et al. 2001). In addition, the Partner, least popular of the three ecocentric types in Visions of Nature studies and for which there was little support in the literature, received high levels of agreement (88.3%). Further, while the responses on the Steward (90.4%), Ecosystem Services (89.4%) and Apathy (13%) concepts do not necessarily contradict the available prior findings, the results are roughly consistent with the expectations based on previous studies.

HUMAN-NATURE RELATIONSHIP AND CONSERVATION

The third hypothesis was that farmer perspectives and reported behavior regarding conservation would associate positively with ecocentric tendencies and negatively with anthropocentric tendencies among farm operator respondents. Furthermore, the relative strengths of these associations were hypothesized to follow the spectrum from ecocentrism to anthropocentrism, strong to weak. The fourth hypothesis was that interest, willingness to adopt, and behavior are associated with human-nature relationships in this sequence from strong to weak. This section first reports on the conservation indices, and then the correlation and chi-square tests that were conducted to assess these hypotheses.

Indices of Conservation

Three indices of conservation were created from survey items. The first was interest in conservation. The second was actual use of conservation practices. The third was a willingness or intent to adopt conservation practices. Here, each index is described in further detail. Descriptions of the practices themselves can be found in the appendix (Appendix B), as is a brief discussion of other factors influencing practice adoption (Appendix C). The practices addressed in the survey have varying degrees of compatibility with production motives (Appendix C).

Interest

One item from the survey, "*How interested are you in new agricultural practices for your farm for conservation?"* was used as an indicator of respondents' interest in conservation practices. This was a 5-point Likert scale (from 1=*Not interested* to 5=*Very interested*) with a relatively high mean (*M*=3.92, *Mdn*=4). Responses were not normally distributed, $D(99) = 0.227$, $p=0.000$, and negatively skewed (-.693, *SE* = .233), with 68.5% indicating high levels of interest (4 or 5 on a 5 point scale).

Willingness

Survey questions on the three less common conservation techniques, drainage water management, wetlands, and bioreactors included an item on respondents' willingness to adopt. For each, farmers were asked whether or not they would be willing to try the techniques (1=*Yes or already do*, 2=*Maybe*, 3=*No*), and how familiar they were with it (1=*Never heard of it*, 2=*Somewhat familiar with it*, 3=*Familiar with it; not using it*, 4=*Currently use it*).

Drainage water management was most popular (*M*=2.13, *Mdn*=2, $D(102) = 0.328$, $p=0.000$), with 58.3% indicating they were "maybe" willing to try. Bioreactors were next

(*M*=2.27, *Mdn*=2, *D*(102) = 0.351, *p*=0.000), and wetlands least popular (*M*=2.36, *Mdn*=2, *D*(102) = 0.287, *p*=0.000), with 48.1% "maybe" willing to try and 44.3% not willing to try. Given their novelty, it is understandable that few respondents responded with a "yes or already do" (12.1% for DWM, 7.5% for wetlands, 2.9% for bioreactors). However, it is also noteworthy that this adoption inclination was not entirely explained by respondents' knowledge of the technology. While farmers indicated they were more inclined to try the bioreactor than the wetland, only 41.7% had heard of a bioreactor, while wetlands were familiar to 81.1%. Similarly, while drainage water management was in current use by 8 respondents (7.2%), only 1 (0.9%) was using a bioreactor, while 6 (5.7%) reported having a wetland.

Respondents' willingness to adopt the three new practices showed an acceptable reliability of α = .70. The distribution was again non-normal, *D*(99) = 0.210, *p*=0.000, with a high peak at 2 ("*Maybe*," 35.5%) and 52% scoring higher than 2, indicating a skew towards a lack of willingness to adopt (*M*=2.29, *Mdn*=2.33). At the same time, only 17.6% answered that they were unwilling to adopt any of the three, suggesting that farmers' adoption inclination for these new techniques may be informed by external considerations.

Conservation behavior

An index of conservation practice was created from a survey question asking about respondents' level of experience with five common conservation practices. Four of the five, nutrient management plan, regular soil tests, recommended fertilization rates, and variable rate application were practiced by 60 to 89% of the respondents and were familiar ("*currently use it*," "*somewhat familiar*" and "*familiar; not using*") to 99 to 97%. Winter cover crops were less popular, used by 10% and familiar to 96%. This is understandable given that cover crops require extra time, energy, and money to plant.

The five items were treated as yes (1=*currently using*) or no (0=*not using*) questions by aggregating responses other than "*currently use it"* as "*not using*." Responses ranged from 0 to all 5 practices (*M*=2.79) and were not normally distributed, *D*(99) = 0.254, *p*=0.000, with a high peak (Kurtosis = .188, SE = .459) at the median of 3 (41.3%) and negative skew (-.62, SE =.231). Additionally, for the purpose of this study, it is relevant to include that 10% of respondents planted winter cover crops while the other 90% did not. Further, the inconsistency in whether or not farmers adopt conservation practices suggests that adoption is dependent upon the characteristics of the techniques. This inequality of conservation practices is important to note when considering the results and valuable insight for our purposes. Additionally, conservation practice correlated positively with interest (*r*=.276, *p*=.001).

Human-Nature Relationships and Conservation

To test the hypothesis on how relationship types associate with conservation, farmers' responses on the conservation indices were compared with their human-nature relationship types. The following table a correlation matrix of Kendall's τ.

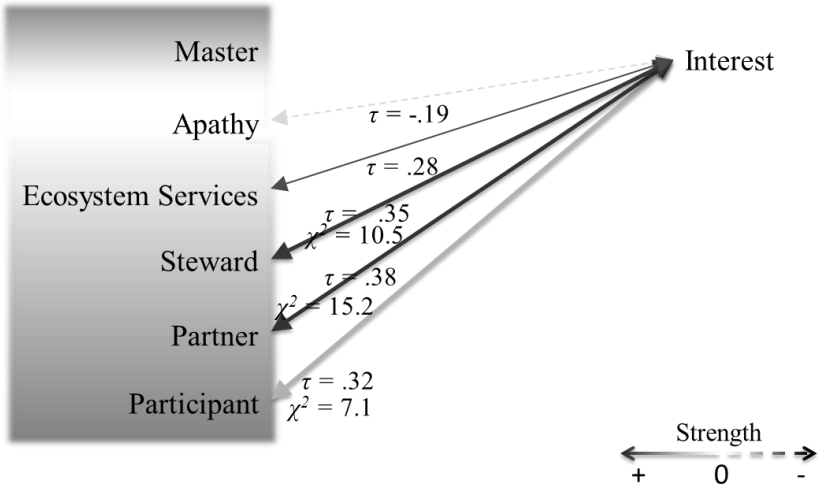
Table 2. Correlation matrix of human-nature relationship and conservation measures

		Master	Apathy	ES	Steward	Partner	Participant
Interest	*τ*	.012	**-.185**	**.275**	**.354**	**.384**	**.319**
	p	.886	.030	.001	.000	.000	.000
	n	102	102	102	102	103	102
Behavior	*τ*	.090	.115	.111	.164	**.229**	**.206**
	p	.274	.170	.195	.056	.007	.014
	n	101	101	101	101	102	101

*Correlations significant at *p*=.05 are boldfaced.

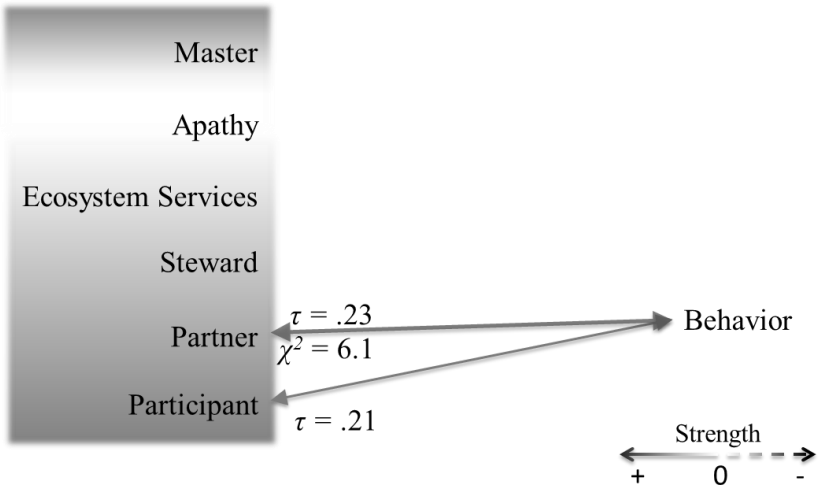
The strongest correlations relationship type and conservation were found with the ecocentric concepts and conservation interest, confirming the main hypothesis of this study (Figure 8).

Figure 8. Chi-square and correlation coefficients for human nature-relationship and interest



Also as hypothesized, interest had a stronger association with human-nature relationship types than practice did (Figure 9).

Figure 9. . Chi-square and correlation coefficients for human nature-relationship and behavior



Agreement with all four ecocentric concepts correlated positively with an interest in conservation practices, (Participant, τ = .319, p=.000, ES, τ = -.275, p=.001, Partner, τ = .384, p=.000, Steward, τ = .354, p=.000). It is notable that the Partner construct had the highest correlation with conservation interest as well as with conservation practice (τ =.229, p=.007), while the

Participant construct had the weakest correlation with conservation interest of the three ecocentric constructs from the Visions of Nature typology. At the same time, this latter construct was the only other original item that correlated significantly with behavior, τ =.206, p=.014. In other words, farmers with higher agreement with the Partner and Participant statements were more likely than those neutral or in disagreement with these statements to be interested and practicing conservation.

In contrast, farmers' responses on the Master construct were not significantly correlated with scores on any of the conservation indices. This is consistent with expectations in the sense that it follows the trend of ecocentric concepts being more strongly related to conservation. However, this finding contradicts the position taken by past scholars (White, 1967) who suggested this concept was at the root of environmental problems. The Apathy variable, meanwhile, was significantly and negatively correlated with conservation interest (τ =-.185, p=.030), indicating that those with higher levels of agreement with the apathetic statement were less likely to be interested in conservation practice. These results contradict the hypothesis that Master would have a negative correlation with conservation, and that Apathy would not be related to conservation. From the perspective of promoting conservation practices, this suggests that while an anthropocentric relationship with nature may not be a catalyst, it is preferable to an utter absence of relationship with nature, which these findings indicate may be associated with less conservation effort.

As for the Ecosystem Services concept, moderate correlation with conservation interest (τ =-.275, p=.001) seems to be consistent with its theoretical positioning. Although a new construct not previously used as a human-nature relationship type and related to the Visions of Nature typology, the Ecosystem Services concept has been critiqued for being too focused on the

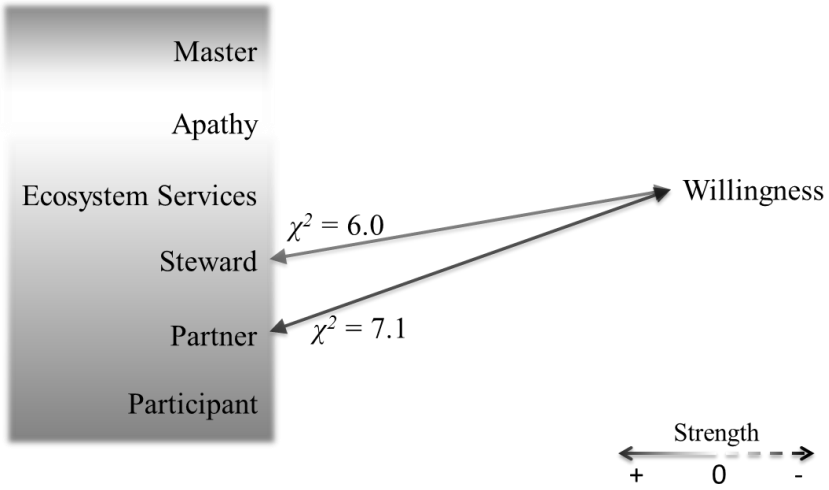
commodification of nature (McCauley, 2006). Implicit in the concept of commodification is that nature can be consumed as commodities by humans. Thus Ecosystem Services as a framework may view humans as central, suggesting its placement towards the anthropocentric end of the ecocentric constructs. Since it was hypothesized that the more ecocentric constructs would have the strongest positive correlations with conservation, the finding that its correlation with conservation is weakest of the four ecocentric concepts is consistent with theory.

Chi square analysis of willingness to adopt new conservation practices

The willingness index was categorical, and required a different sequence of statistical tests than those that could be conducted with the interval measures of conservation interest and practice. Subsequent analyses of willingness with each of the human-nature relationship items experimented with more appropriate techniques using chi square test of independence and one-way ANOVA. Of the variations of the willingness and relationship type variables that were tested, one combination yielded statistically significant results. For willingness, respondents were grouped as those who were willing to adopt any practice (16.5%), those who responded they might be willing to adopt a practice (65.1%), and those who were not willing to adopt any of the practices (18.3%). For the chi-square analyses, human-nature relationship responses were split into two categories at the median. When relationship variables were split so that the median response was grouped with the lower-scores, Steward, χ^2 (2, N=102) = 6.04, p=.049, and Partner, χ^2 (2, N=103) = 7.15, p=.028 had a significant association with willingness. Both had a median response of 4 out of 5 (1=*strongly disagree*, 5=*strongly agree*), and the strongly agreeing category comprised roughly half of the responses (45.1% and 45.6%, respectively). These results are consistent with the correlations between the relationship types and interest and practice in that the Partner concept is most strongly associated with farmers' willingness to adopt

conservation practices, followed by the Steward concept (Table 2). No significant associations were found between willingness and the 5-point relationship items in the ANOVA.

Figure 10. Chi-square coefficients for human nature-relationship and willingness to adopt



Chi-square analyses were also run with the interest and practice indices for comparison with willingness. As with the 5-point relationship items, responses on interest were split into two groups at the median of 4 (1=1(*Strongly disagree*) to 4, 66.7%, and 5(*Strongly agree*), 33.3%). The index for conservation practice was based on the number of common practices that the farmer had adopted. Responses were split into three categories (1=*0 to 2 of 5 practices*, 32.1%, 2 = *3 practices*, 41.3%, and 3=*4 or 5 practices*, 26.6%). The results are consistent with the hypothesis that the farmers' agreement with the relationship items is associated most closely with interest (Steward: χ^2 (1, *N*=102) = 10.51, *p*=.001; Partner: χ^2 (1, *N*=103) = 15.24, *p*=.000), followed by willingness, and lastly, practice (Steward: χ^2 (2, *N*=101) = 5.31, *p*=.070; Partner: χ^2 (2, *N*=102) = 6.08, *p*=.048) (Figures 8 through 10, Table 3). According to Sun and Pan (2010), relative effect sizes can be interpreted based on the Cramer's *V* values. These *V* values range from 0 to 1 and are identical to Pearson's correlations for 2x2 matrices. Most of the chi square

analyses indicated medium effect sizes, between .21 and .35. Partner and interest was the only case of a large effect size. Additionally, odds ratios can be calculated for 2x2 chi squares for a more intuitive statistic. For example, the odds of a respondent expressing strong interest in conservation practices was 7.17 times more higher if they strongly agreed with the Partner statement (V=.385). The respective ratio was 4.91 for respondents who strongly agreed with the Steward statement (V=.321). For comparison, one 2x2 chi square between an alternate grouping of willingness tested significantly (Partner: χ^2 (1, N=103) = 5.11, p=.024). Here, the odds of a respondent expressing a willingness to adopt any of three uncommon conservation practices was 3.5 times higher if they agreed strongly with the Partner statement (V=.223). Overall, these chi square results support the hypothesis that the abstract concept of relationship with nature is more strongly associated with interest than with actual practice. This suggests that there may be other considerations that factor into farmers' adoption of conservation practices, even if they are theoretically interested. Some exploration of this notion can be seen in Appendix E and F.

Table 3. Results of Chi-square analyses of human-nature relationship and conservation measures

		Master	Apathy	Ecosystem Services	Steward	Partner	Participant
Interest	χ^2	0.113	1.417	3.090	**10.512**	**15.243**	**7.096**
	p	0.736	0.234	0.079	**0.001**	**0.000**	**0.008**
	Cramer's V	0.033	0.118	0.174	**0.321**	**0.385**	**0.264**
	n, df	1, 102	102, 1	102, 1	**102, 1**	**103, 1**	**102, 1**
Willingness	χ^2	1.371	0.651	2.294	**6.036**	**7.145**	2.854
	p	0.504	0.722	0.318	**0.049**	**0.028**	0.240
	Cramer's V	0.116	0.080	0.150	**0.243**	**0.263**	0.167
	n, df	102, 2	102, 2	102, 2	**102, 2**	**103, 2**	102, 2
Practice	χ^2	3.110	1.838	0.339	5.310	**6.078**	3.623
	p	0.211	0.399	0.844	0.070	**0.048**	0.163
	Cramer's V	0.175	0.135	0.058	0.229	**0.244**	0.189
	n, df	101, 2	101, 2	101, 2	101, 2	**102, 2**	101, 2

*Correlations significant at p=.05 are boldfaced

DISCUSSION

Consistent with the hypothesis, survey results of Embarras watershed farmers contradicted the distribution of human-nature relationship types in previous studies. Close to a third of survey respondents agreed with the statement of the Master concept (28.7%), which has been said to be virtually nonexistent in Western Europe's general population. (M. de Groot, 2012). As expected and consistent with previous studies, Apathy was the least popular (13%) of the typology, and the ecocentric concepts were met with higher levels of agreement. Overall, the Steward concept was most popular (90.4%), followed closely by the Ecosystem Service (89.4%) and Partner (88.3%) concepts. While the general public in Europe and the US was said to prefer the Participant concept (van den Born et al. 2001), results confirmed expectations based on previous studies of farming populations. As in the Iowa farming community Herndl et al. (2011) studied, the Participant was the least popular of the ecocentric concepts (69.1%). The high levels of agreement with multiple relationship types also confirmed the multiplicity of respondents' human-nature relationship types. Not only did most survey respondents agree simultaneously with multiple statements (94.7%), over a third agreed with seemingly contradicting human-nature relationship concepts (34%).

The third expectation was that conservation practices would be positively associated with agreement with ecocentric human-nature relationship concepts. The directionality of the significant correlations between human-nature relationship types and indices of conservation were consistent with expectations. The Partner concept was most closely associated with conservation, followed by Steward. The Participant concept had the weakest connection to conservation of the three ecocentric Visions of Nature items. This was unexpected, as the Participant concept is the most ecocentric of the three. One explanation may in fact be this

extremity of the concept, and the tendency of farmers to disregard such concepts as private feelings (Herndl et al., 2011). Further, the weakness of the Steward and Ecosystem Service concepts' link with conservation compared to that of the Partner concept may in part be explained by the high levels of agreement with these concepts. A ceiling effect may have obstructed a more organic expression of respondents' relationship with nature in the survey and its association with conservation.

The final expectation, that human-nature relationship would be associated with conservation interest, willingness, and actual behavior in this order from strongest to weakest, was supported by the respective effect sizes found in the chi square analyses. Results of correlation analysis of HNR and conservation interest and behavior were also consistent with this hypothesis.

The survey portion of this thesis indicates the uniqueness of farmers' relationship with nature, and generally supports the hypotheses. However, the inferences that can be drawn from respondents' level of agreement with six statements are limited. The next chapter follows up with the explorative analysis of the qualitative portion of this thesis.

CHAPTER 5

INTERVIEWS

The qualitative portion of this study augments the survey portion with the explanatory power of its findings. Farmers' own articulation of their relationship with their land expanded upon the distribution of typological types seen in the survey. The analysis also allowed for emergent themes such as theoretically conflicting relationship types and affection for the land. Additional decision making concerns further detailed how human-nature relationships relate to nutrient management. Many of the informants' own words speak through the chapter, adding richness to the overall picture of farmers' human-nature relationships.

HOW ILLINOIS FARMERS RELATE TO NATURE

Well-intentioned Stewards

Most noticeably, interviews with farm operators, employees at farm management agencies, and landowners in the Embarras watershed mirrored farm operators' high level of agreement with the ecocentric human-nature relationships in the survey. One farmer summarized, "we're trying to farm with the best farm practices we can, and its' a learning process." Furthermore, several farmers explicitly identified themselves as stewards of the land. A number of farmers highlighted this notion, "I would point to say that what I do, everything I do out there is trying to be a good steward and conservation-minded." This underlying notion of farmers as well-intentioned stewards is a central tenet of the qualitative findings of this study.

Farmers' self-identification as 'stewards' closely aligned with the theoretical concept of the Visions of Nature typology. Their sense of responsibility rooted in the concern for future

generations and in the biblical notion of the steward were characteristics of the Steward type. For example, some farmers articulated their alertness to the multi-generational scope of land care.

> I mean, we've only been farming this land here for, what, maybe 140-150 years. That's a pretty short time frame compared to what we've done to this earth in that short of time, and what's the future gonna hold if we don't learn how to do this environmentally. So that's the big key for me. I've got sons and grandsons that I think will wanna farm and what's it gonna be like in 70 years if we don't start taking care of some of the issues now?

This quote exemplifies farmers' recognition of their role as a Steward of their land to future generations. Moreover, the implication of how this consideration may influence farmers' land management decisions supports the third hypothesis, that ecocentric concepts are positively associated with conservation.

Nonetheless, of the Visions of Nature types that fall under the ecocentric category, the Steward is the second most anthropocentric concept. Although nature's intrinsic value is recognized, the relationship itself is instrumental (Zweers, 2000). The following quote from a retired farmer captures some sense of this anthropocentric motivation for conservation practices.

> The good lord gave us the Earth; I think we should take care of it. That's always been our philosophy throughout the years, don't be throwing a bunch of junk down because you should take care of things. …Some of these viruses that they have are pretty strong and if they get into the soil, they'll get into the food

Thus, this farmer expresses a predominant concern for people's well-being. Further, much like the informants in the ethnographic study of Iowa farmers (Herndl et al., 2011), he

alludes directly to Stewardship as a religious obligation. The sense of moral obligation towards future generations and for religious reasons expressed by many of the interviewed Embarras farmers is consistent with the theorized Steward concept. The interviews thus add depth to the high level of survey agreement with this concept.

The Partner

While the Steward concept was most recognizable and repeatedly mentioned in the interviews, other forms of ecocentric concepts were also recognizable. One farmer used the term "partner" to respond to the directed question about his relationship with nature. Affirming the hypothesized multiplicity of farmers' relationship types, this concept appeared intermeshed with the Steward concept in a number of interviews. In these instances, respondents were cognizant of their own "time frame" on a land that was and would be passed on from farmer to farmer. However, in addition to this Steward mindset, they expressed a desire to leave the land in better condition than it was and implied a greater intimacy and collaborative relationship with the land. As opposed to the Steward, whose main aim is to preserve the land as it is, the Partner intends to collaborate with the land towards improvement (Zweers, 2000).

> I'm 77 years old, I was born on the farm, lived there all my life, … it's my goal to leave the farm and everything about it … in better condition than it was when I got it. … I can't see just running through it, for lack of a better work, just raping the farm and the land and everything, I don't believe in that. ... my Grandfather, he came here to the United States when he was 18 years old and came and started buying it and farmed it before it was drained and he had a vision that it was going to get better and I guess that's still my vision that it's gonna get better and better. Then my

> Christian belief, the Bible tells me I'm to be a good steward of everything that God has provided for us, and I don't believe that if you so-called "rape" the ground, that that's being a good steward.

This retired farmer's explanation of his motivations for using practices such as side-dressing fertilizer, conservation tillage, and riparian buffers exemplifies the overlap between the Partner and Steward concepts that makes parsing the two a difficult task. On the one hand, his sense of responsibility as a Steward to the Christian God is prototypical. The recognition of his grandfather's influence also suggests that he views himself as part of a succession of generations, and that his intent to steward the land may in part be driven by a concern for future generations. On the other hand, he clearly views the betterment of his land as integral to his role on the land. The personification of the land with the word choice of "rape" may be coincidental, but implies recognition of the land as an active agent capable of collaboration with humans. In theory, a Steward would not view nature as capable of active interaction (Zweers, 2000). Whether this indicates a multiplicity of his relationship type or a fuzziness of the Partner and Stewardship concepts in particular, the occurrences of the Partner concept in this study affirm previous studies where these two concepts were found to be indistinguishable (W. de Groot & van den Born, 2003; Hunka et al., 2009). As with the Steward type, excerpts elucidate the positive association between the ecocentric concept and indices of conservation in the survey.

The Participant

The Participant concept was expected to find low levels of adherence, and the few mentions of this concept in the interviews confirmed some sense of tension with this idea. On every occasion in which informants alluded to a being part of their land, they made clear indication that they did not identify as the stereotypical environmentalist or qualified the notion

by putting it in perspective of their farming operations. For example, a landowner explains, "we're conservationists but we're not tree-hugger, rabbit hole type," echoing Herndl et al.'s (2011) study of members of the Iowa farming community who distanced themselves from the 'tree-huggers' with regulatory agendas. In the following excerpt, a farmer similarly clarifies his aversion for the "tree-hugger" while discussing his conservation practices that prevent sediments and nutrients from running down his field into a nearby lake.

> I've come to understand how, I hate The Lion King and the circle of life deal, but that's a different thing, but I understand everything affects, everything is interrelated and affects other things. … everything I do out there is trying to be a good steward and conservation-minded. … I'm that lake's best friend 'cause I'm right above it, and I'm the guy that could dump a lot of stuff into it, but we don't. ... I don't go around thinking I'm somehow part of the land somehow, but really, I am, in that the decisions I make are usually conservation-minded, and conservation for the long term, too.

This farmer explicitly distances himself from the Participant concept while acknowledging and working with the interrelatedness of natural ecosystems that defines Participants' understanding that humans are part of the broader functions of nature. Here again, the farmer's self-identification as a steward and the "best friend" of the lake and farm makes it impossible to classify him as an adherent of a singular human-nature relationship concept.

Affection towards land

Regarding the character of their bond, farmers further expressed a sense of affection towards their land. For the long time farmers who had been raised on their land and expected

their children to carry on the operation, this sentiment was closely linked with their family history.

> I mean, my Grandpa was a farmer, my Dad was a farmer, and I wanna pass that on so my love for the land is to preserve it, maintain it so that future generations can have what I have now.

For others, the affectionate bond with a particular piece of land developed regardless of ownership or legacy. The following farmer describes his attachment to a land that he rented.

> …for anybody who has farmed very long… for whatever reason it's pretty tough just to drive by that farm the next year when someone else is farming it. It's strange that way. It's a business but it's personal. That would describe me, its business but it's personal.

The duality of the business and personal aspects of farming will be discussed later in this chapter as a major theme in farmer's relationship with their land. Meanwhile, both owners and renters of land alluded to these affective qualities of the relationship as contributing to their desire "to do [their] part" and take care of the land, consistent with the lack of significant associations between tenancy and relationship or conservation in the survey (see Appendix F).

Other farmers expressed affection for the biological elements of their land in ways that were reminiscent of biophilia, the love for life (Wilson, 1993). Asked about his relationship with nature, one farmer exclaimed,

> Oh it's a first love. Green plants and clean soil, doing a good job of protecting the soil and increasing the fertility of it and increasing the organic matter and so forth and so on. We could talk a long time on that.

For this farmer, the "first love" was linked to the Steward and Partner motivation of protecting and bettering the land. Another active farmer was enthusiastic about ecological activities in the area, ranging from aquatic life in the river to the sunrise and the "inspiring and eerie" coyotes. While he described himself as using "conventional tillage methods," he was "sorry to see the environment [had] changed so much so that we don't have wetlands and we don't have woodlands." Later on in the interview, he also explained that his affection for nature had some degree of influence in his farm decision making. Thus, these emotive aspects were an important dimension of farmers' relationships with nature, with implications on farming practices. While past notions of ecocentrism do not necessarily specify such character of the relationship, these excerpts suggest that affection may be one component of the confirmed link between ecocentric forms of human-nature relationships and conservation.

COMPLEXITIES OF FARMING

As in the survey, what emerged out of the interviews as a major conclusion is that the majority of the farmers interviewed expressed some sense of responsibility or care for their land. Most often, this could be interpreted as some rendition of the Steward concept. The Partner and Participant concepts and affection for farmland were also recognizable. While this is consistent with prior studies (M. de Groot, 2012; Vining et al., 2008), farmers' unique position of earning their living off of the land is unlike that of most urban residents. As the interviews reveal, the difference provides substantiation of the second hypothesis that farmers' relationship with nature differ from that of past general public samples.

Many farmers explained their occupational predicament of the working relationship with their land. Their distinctiveness from the general public and "the tree huggers that don't ever want to touch anything and let it go back to the natural state" was evident. One farmer responded to the directed question to his relationship with the land and nature, "Oh, you know, I like it. I love it, you know, but uh. I think that all that has a place. When it gets in the way of farming, you know. I don't … like it.*"* A strong affinity for the natural landscape is evident, and he explains this led to his decision to purchase his land. At the same time, he alludes to an internal conflict between this emotional relationship with nature and his role as a farmer. This dissonance emerged repeatedly out of the interviews, reinstating survey respondents' agreement with multiple and seemingly contradictory human-nature relationship types. This section discusses the more practical aspects of farming that play into farmers' relationship with their land and nature.

Production values

Practically speaking, food provision for the growing world population is a dominant characteristic of the agricultural sector. The following farmer agrees with others in dissociating a sense of respect and affinity for the aesthetic and ecological attributes of the land from his role as a farmer.

> Everyone wants to look at the watershed according to its natural form and those sort of things, which is fine, but you can't discount on the importance of allowing farmers to fix drainage and improve drainage and that sort of thing because without that we can't produce the food to the world is gonna need. You can't do it right, you allow a few more wetlands to be formed, a few more ducks, I have nothing against wildlife, I love it and promote, but there is a place for it and we can't ignore the need for the tools we need to have high production.

This farmer was rather unusual in planting an alternative crop for biofuel, miscanthus, on some of his marginal lands. Though this demonstration of his openness to innovation might lead one to expect him to be more willing to take greater measures towards conservation, he makes clear his support for the intensive production methods he views as necessary to feed the world. Similarly, another farmer distanced himself from the "tree hugger" agenda while acknowledging the importance and desirability of ecological integrity. Compromise, he explained, was a necessity for fulfilling farmers' provisional role. "… yes, we want good water quality, but we also have to be able to produce all the food we can to feed people and you can't go overboard on one way or the other. " These excerpts suggest the dominance of the farmers' role as a food provider over their personal or emotional concerns for the ecological and aesthetic aspects of their land, harkening back to interviewees in the Iowa farming community who put away these latter aspects of the human-nature relationship as 'private feelings' and supporting this explanation of the relative weakness of the association between conservation and the Participant concept.

Given the importance of food provision to farmers, their valuation of productive land is not surprising to hear. One landowner declared, "I'm not gonna build a subdivision in my back yard or anything. Even if it made a lot of money, I wouldn't." Productive land appeared to be a deeply engrained value, and its protection from other uses such as sprawling development, an ethical obligation. This notion translates to the daily upkeep of cultivated land, as the following farmer observes,

> …a lot of people won't take care of it—you see weeds, and pretty soon you see an old car, an old truck, you know, sittin' out there on good land. And then you got people there on TV, people over somewhere—of course a lot of 'em can't afford

> it—are starvin' to death. You think, geez, several thousand acres of land sittin' there with old cars and trucks and weeds. If they would've farmed that

A keen awareness of the need for food production informed this farmers' valuation of agricultural lands. Another farmer, one of few who had agreed to have a wetland restored on his property, indicates how the value might also influence farmers' adoption of conservation practices.

> …my area here was very conducive to being able to put these wetlands in. There's some areas that just aren't that conducive. Guys would have to give up valuable land production to do that, this was easy for me to do because it was kind of a wasteland anyways and so by promoting that, that worked out very well.

The conduciveness of his land and its marginal value for production may have been conditions for his willingness to develop a wetland. Indeed, production also surfaced as a precondition when considering the adoption of conservation practices.

The interviews revealed farmers' and landowners' valuation of productive land as impacting their relationship with nature and its manifestation in conservation action. One landowner questioned the boundary of regulatory restrictions on nitrogen fertilizer, "Everybody loves clean air, but does that mean I have to not farm anymore because that's too much dust?" A farmer similarly discussed the need for a balance between conservation and production, noting that conservation in its extreme would call for no production.

> If we would quit doing everything and let it grow into pasture, we could have excellent water quality. But you can't have both, you've got to feed the people and you want to try keep things as ecologically balanced as you can.

As such, farmers expressed the oppositionality of optimal practices for production and for ecological integrity. These excerpts illustrate how the heightened awareness of the necessity of production for filling society's demand for food may be impacting farmers' decisions regarding land management and conservation.

Vulnerability

Given the importance of production to the farmers, the vulnerability of crop production to environmental conditions is a critical consideration. This sense of vulnerability and of opposition with nature was detected in a number of interviews. For example, one farmer commented on the issue of nitrification, "You know all that type of stuff, you just can't control Mother Nature. The first influence that they usually look at is trying to blame man and it's not always man's fault." The portrayal of "Mother Nature" as superior to humans and himself and the sense of being "part of the farm" that he noted elsewhere in the interview suggests a close fit with the Participant concept. In contrast, another farmer describes humans as capable of fighting against the forces of nature.

> Years ago we didn't have insecticides, and we didn't have herbicides. Most all that stuff was all manual. You had to take care of all the weed problems, you know, manually. You got bugs, you were just doomed. Because you couldn't fight 'em—there was nothing to fight 'em with. You know, the seed corn, seed beans have come a long way—a lot better than what they used to be. But they still got a ways to go ... they do their beans better now—they coat the bean with a lot of insecticide and so forth, to kind of help it get a little more push. They're better, but they could still do better than what they do. You pay all that money for 'em, you know, you want 'em to be a little more fool-proof.

This farmer's account of the "fight" with weeds and pests evokes the theoretical discussion on how society's relationship with nature has evolved over time. Much of this discussion has focused on people's historical endeavor to control and master nature (White, 1967; Brady, 2009). Meanwhile, more empirical works have suggested recent changes in this relationship (de Groot, 2009). But while modernized society and industrial farming are said to have "alienated" people from nature in recent years (Brady, 2009, p. 9), the immediacy of farmers' dependence on nature for their livelihood and their ensuing vulnerability to natural conditions are unique. In their vocabulary, 'Mother Nature' is not the beneficent provider of human needs as implied in the Ecosystem Service concept (Flint et al., unpublished manuscript), but a powerful and insurmountable force. Similarly, while the 'countryside' may evoke an image of pleasant greenery and recreational landscapes for the general public, a farm landowner describes country life, "It's noisy, it's messy, it's dirty." These accounts are consistent with the hypothesis that farmers may have a unique relationship with nature and more likely to agree with the Master concept, found to be nonexistent in parts of Europe (M. de Groot, 2012). They also illustrate a commonality between the Participant and Master concepts that the agricultural context brings to light. The understanding of nature as superior to humans is closest to the Participant concept. The Master approach to dominating nature is based upon the understanding that nature must be subdued. However, this might be extrapolated as an understanding that neglecting to keep up the fight against nature would allow nature to take over and pose a threat to people or their aims. Despite the polarity of the two concepts' position according to the theoretical spectrum of ecocentrism and anthropocentrism, the interviews thus reveal a shared theme of vulnerability to nature.

Trust in technology

Another aspect of people's relationship with nature with possible impact on land management practices is trust in technology. The Master concept has historically been associated with greater reliance on technology as a means for battling the oppositional forces of nature. In contrast to a previous excerpt of a farmer accounting for the ways in which technological developments had empowered him in the battle against weeds and pests, the following farmer discusses how newly developed chemicals reduced detriment to the land and people.

> We're using a lot safer chemicals nowadays than we used to use. Some of the old stuff we used was pretty potent, I mean it about eat your skin off, it's bad. But now this newer stuff, the roundups and whatever, is you know, a day later it's gone, it isn't there. So on that end, the chemistry end, I think there's been some major improvements there. And then we went to this triple-stack corn so we wouldn't have to use so much insecticide, it cut our insecticide down really low on that. Well, that's, anything that's got a skull and cross bones on can't be too good for anybody. But everything we're doing, you know, it's all been passed, inspected and certified and all that stuff. We're not using anything off-label. We're trying to do the best job. We're not chemists, we're not water people, you know. We know what good water looks like, and we need good water.

In this example, the farmers' dominant perspective on his relationship with nature may be more appropriately characterized as Steward or Ecosystem Service related. Yet, his physical function on the land renders him inseparable from technological development, which in theory is most closely linked to the Master type. In this sense, farmers may yet again be thought of as a demographic with distinct human-nature relationship characteristics.

Appearance

Field appearance surfaced as another value likely impacting farmers' attitudes toward conservation. Linked closely with the Master concept, conceptions of how the land ought to look may inhibit the adoption of certain conservation practices. The following no-till farmer was conscious of the 'ugliness' of no-till farming and suspected that its appearance may be a major inhibitor of more widespread adoption of the practice.

> It wasn't what you were used to seeing. I called it, for the purpose of everything I was doing, I called it farming ugly 'cause it just doesn't look good at the beginning and that's one of the major drawbacks to the no till and I think everybody was a little suspicious of the yields and management and stuff like that just doesn't happen overnight. It takes a while for stuff to get going.

This farmer was not alone in recognizing the appearance of more hands-off management approaches as a consideration. While he had employed conservation tillage despite its appearance, others were more condemning. One farmer disapproved of the messy appearance of out-of-place trees as looking "like a jungle." Others resisted the idea of nullifying the extensive effort he had put in to control the weeds on his property.

> I remember a couple of farmers saying, "You know, I really didn't buy that land, I didn't work my ass off, you know, chop the weeds out of there before they had chemicals, for years and years and years, to let it grow up in weeds. So I don't think we're going to put up any more of that CRP. I'm not interested at all in a couple of foreigners telling me."

While this farmer's motivation for weed eradication may have been other than a Master mindset, his sentiment suggests that the orderly appearance of fields, prized amongst UK farmers (Burton, 2004), may also be of importance to farmers in the Embarras watershed. From the association of orderliness with the farmers' skills in this previous study, it can be inferred that the Embarras farmers may also prefer to maintain their lands under high levels of visible control. High-intensity practices are counter to conservation practices such as leaving fallow land or reduced tilling, but may be in favor of practices that increase farmer's ability to monitor and manipulate the land, such as soil testing and drainage water management. Notably, most of the practices addressed by the behavior and willingness indices fall under this category, practices compatible with increased productivity.

Both the no-till farmer's decision to discount the 'ugliness' that he understood had discouraged others in his community from adopting no-till, as well as the latter farmer's resistance against being told what to do by "a couple of foreigners" harkens back to the intimacy of the informants' relationship with the land. Like productivity, informants expressed outward appearance of agricultural lands as a fundamental value that influenced their interest in conservation practices.

The Bottom-line

Consistent with expectations, the farming population made frequent references to the economic viability of conservation practices. For landowners and farmers alike, cost-benefit analysis was integral to decision making. "...it usually boils down to money," concluded one farmer. Another was conscientious of his fertilizer use, but explained that this did not translate directly to action or to a prioritization of water quality over yield.

> I'm fertilizing for my yield so I mean they're trying to limit there but as far as seeing the quality [of the water] and saying oh I'm gonna make a big decision on it, I think it's probably down low, it's more of the economics part of it.

The importance of financial considerations provide some explanation for the weak relationship between farmers' relationships with nature and indices of conservation in the survey, as these farmers and landowners' decision making is based primarily on cost-benefit and yield considerations. However, these statistical tests returned significant associations between relationship types and conservation, even despite the complex realities of farm management.

For many, the bottom-line took precedence in spite of their awareness of environmental issues and ecocentric ideals. "Everybody wants better water quality but you have to see the cost associated with those things that you would do," explained one farmer. Others clarified, "I've still got to make money at it otherwise I won't be able to do the right thing." "[You] want to make enough money to do it again next year." While these farmers did not deny an interest in water quality, they explained that the financial viability of their operations necessitated economic viability for the adoption of conservation measures. The predicament is illustrated by this retired farmer, who stressed the importance of conservation while agreeing on economic viability being a prerequisite.

> …conservation and preservation would be the number one, and then of course profit has to enter into it, it can't be cost prohibitive, you have to be able to make an equal or better income from it. … I guess my number one is conservation and my number two is profitability.

The underlying relationships with nature could be interpreted in many ways, but it is notable that he noted "equal or better income" as a precondition, even as he stressed conservation as the top priority. The juxtaposing priorities speak to the internal conflict that farmers may be experiencing between their desire to steward their land for ecological integrity over the long term and the need to financially sustain their business.

Anthropocentrism

Not unlike the anthropocentric concern of feeding people, responses indicated the predominance of human interests in some interviewees' concern for water quality. For example, a number of farmers explained their concern for water quality as stemming from a concern for people downstream and for their own drinking water.

> [Water quality is] a high concern, yeah. I mean that's where our drinking water comes from. We have a well here and its only 50-60 feet deep and so, yeah, if we do something wrong here and screw up our well, what are we gonna do for water? We don't have city water out here so, yeah, and then this water goes to Charleston and they get their drinking water from it so, yeah it is. That's kind of why we did all that we can do out here now.

Similarly, others explained that some conservation practices were motivated by water quality concern for human consumption. "…that's why we recognize that we can get a filter strip along there. We knew the people downstream drink that water, bathe in that water. We want to try to make it as clean as possible." The presence of anthropocentric concern does not necessarily indicate a lack of more ecocentric views on the matter. However, the fact that human usage was the first association that many farmers made with water quality may indicate either

anthropocentric tendencies in their human-nature relationships or that this relationship is less prominent in their daily lives.

Apathy

While concern is a distinct concept from relationship, it may be reasonable to interpret a lack of concern as the result of Apathy, the lack of a relationship with nature. One informant made it clear that water quality was not one of their concerns. “In the past we talked about the hypoxia down in the Gulf of Mexico and so on and so forth but that’s a long ways off for our concern.” Other farmers and landowners also implied that they were currently distanced from nature. “I’m not a kid out playing in the ditch anymore,” remarked one landowner. Though concerned about the quality of his drinking water, he explained that he was removed from the quality of surface water and wildlife activities. The absence of a relationship would be least likely to be made explicit in an interview, and these excerpts do not directly express Apathy. However, the dominance of anthropocentric concerns as well as implications of being removed from nature may evince some degree of apathy or a weaker relationship with nature amongst a subset of the sample population.

One excerpt more directly illustrates the possible lack of human-nature relationship. The farmer, who in other sections of his interview expressed an antagonism towards the inconveniences of natural processes on his land such as weeds and pests, here expresses a lack of consideration for nature.

> This year, was a real real good example. Especially the corn. The root worm. … when it dies like that, it just goes to hell. And the yield goes way down, of course. …it just lays there because it’s dead. And it was a mess this year for some

> varieties. … I called [our salesperson] and I says, "Why don't you just get out here and look at this shit?" And he started tellin' me that it was this and it was that. And, you know, it was the weather, it was the wind, it was this. I says, "[John], you know bottom line, the corn ain't worth shit." I said, "Just say that." [laughs] I'm gonna come unglued, here. He said yeah, we're not gonna sell any more of that. Said, "That's what I wanted to hear. We don't need any more of that shit on this farm."

This farmer's focus here is singly on his yields, and his disregard for natural phenomena is particularly evident in his response to the salesperson's explanation that the crop failed due to weather events. His demand for seeds that yield regardless of natural conditions demonstrates high levels of expectation and reliance in technology. On a gradient, this farmer's notion of consideration and control of nature is at polar opposites with others who refer to "Mother Nature" as being beyond human control. While the dominant human-nature relationship for this particular farmer may be closest to the Master concept, this excerpt illustrates how Apathy regarding nature may lead to more aggressive practices and a lack of consideration for conservation efforts.

ADOPTION OF CONSERVATION PRACTICES

Thus far, the qualitative portion of this thesis has shown the breadth of relationship types between the informants and their land. This section further elucidates on the ways in which the various relationships manifest in the context of farmers' land management practices. The concept of Ecosystem Services is central in this realm, and appears in various amalgamations with the other relationship types. While the difficulty of parsing out the relationship in terms of the theoretical typology remains evident, the analysis also indicates that the concepts nevertheless capture many definitive aspects of the informants' human-nature relationships.

Compatibility

Farmers often recognized the compatibility of certain conservation practices with economic interests. "… luckily, what we're doing seems to go hand in hand [with water quality]," commented one farmer, explaining that preventing nitrogen leaching was a "win-win" situation. "[Nutrient loss is] really expensive from like my checkbook's standpoint," commented another, recognizing the financial lucrativeness of waiting to apply nitrogen fertilizer until the spring. These excerpts were made by informants with varying human-nature relationships, and indicate that the prioritization of the bottom-line is not necessarily detrimental to the environment. This may also explain the popularity of the Ecosystem Services statement in the survey, as the concept captures the compatibility of anthropocentrism and conservation.

Relationship with nature's benefits

The benefits of Ecosystem Services were also recognized more broadly. For the following farmer, the awareness of people's reliance on nature's services was a key component of his relationship with nature

> … water quality is one of those things that in general people don't care until they turn the tap and it's either not there or there's something wrong with it. We don't think about it daily. ... farmers are more aware of it than maybe a non-farming community. … [But we] have to be aware of it. We have to be concerned with it. …as a farmer and as a steward of the land, I have to take care of it, yeah.

This farmer was cautious of sounding alarmist about conservation, but took a Steward-oriented perspective and was highly cognizant of the benefits of nature. Another farmer reflected a similar awareness of the benefits of nature in his actions. "I've planted over 60,000 trees out here in the

last 15 years and because I know what it will do. The other advantage to this is, it helps with flood control on the downstream owners." While these two farmers were unusually direct, they were not alone in recognizing the benefits of Ecosystem Services. "We'll give just a little bit of profit for good till, good soil management, good insect control and so forth, which actually adds to the total yield," commented another farmer, more closely focused on his operations. These examples illustrate how the understanding that "good" practices could amplify beneficial ecosystem functions may be contributing to farmers' decision making.

Notably, many of the farmers focused primarily, if not solely, on benefits to themselves or to other people. In other words, they recognized the benefits of nature without necessarily acknowledging the provider of the ecosystem services, nature itself. Much like the Steward relationship, theoretically intercepted by an obligation to future generations of to God, the Ecosystem Service relationship is a human-nature relationship that can be intercepted by the benefits of nature.

Collaboration

Though limited, there was some indication that the consideration also extended beyond Ecosystem Services to the service provider. These instances evoke a sense of Partnership, which was the concept most closely associated with indices of conservation in the survey. One retired farmer who practiced conservation tillage explained, "...we don't moldboard plow and just let the worms do their trick." Some degree of a collaborative mindset with ecosystem functions can be inferred here. Like other similar instances of farmers recognizing the benefits of ecosystem services, this mentality may also be interpreted as an indication of the Partner concept. Another farmer recounted a saying in her family that "If you own land you may not get rich, but you won't go to the poor house either. If you treat it decent. " These quotes imply a sense of

collaboration, where the integrity of the land and the farmer's well-being are contingent on one another.

Forms of conservation

Farmers in this study agreed with all types of human-nature relationships, including the most anthropocentric Master type. This allowed for the exploration of the expectation that conservation is positively associated with ecocentrism and negatively associated with anthropocentrism. In doing so, the interviews revealed ways in which conservation was aligned with anthropocentric interests. As a result, they also indicated ways in which a breadth of relationship types could be compatible with conservation.

Control

Many land management practices were seen as economically conducive, and interviews suggested that a Master mindset would not preclude engagement in conservation. For example, this farmer describes one context in which the economically and ecologically sound practice involves opposing a landscape's natural tendencies.

> You just have to spend more money on rolling ground to keep it under control so you don't lose it 'cause you don't want to lose your top soil, that's your producing ground. There is so much you have to do.

Erosion may not be such a critical issue even on hilly ground if land usage was not as intensive as the agricultural practices in the study region. Nonetheless, this provides one example where the control-oriented approach to land management characterizing the Master perception aligns with conservation interests. As the following excerpt further clarifies, agriculture involves the

active transformation of land. This reality in itself could be interpreted as aligning with the Master concept.

> We redo our own waterways, we picked up farms that had waterways that were all, wasn't working right, the water was going where it shouldn't go, erosion was really bad. We straightened out waterways, we dug ditches along roads and whatever, tiled everything up trying to get things, you know that need to be done. And, you know, it doesn't always pay to do this kind of stuff, but it needs to be done. To, you know, help the cause, you know, get the water running faster, get it running off but not have erosion or whatever.

This farmer was aware of the ecological ramifications of his practices, and prioritized factors other than his personal gains in his management decisions. While his underlying motivations might also be characterized as one of Stewardship, a pervasive sense of having to control the land to suit his conceptions of how his land ought to look and function makes this excerpt also represent the Master concept. Thus, these examples illustrate ways in which the Master concept may manifest itself in farmers' adoption of conservation practices.

Care

Meanwhile, informants' ecocentric ideals also influenced their land management practices despite the financial circumstances. "…we try to choose our fertilizer rates to give us a shot at high yields but maybe not maximum yields thinking that certainly it doesn't help to just throw things out there," explained one farmer, considering nutrient runoff in his fertilization practices. It is further notable that the attitude this farmer took does not indicate that he was motivated by a sense of obligation or responsibility, which was otherwise common. His

reasoning further supports the possible agreement with the interconnected aspect of the Participant concept. For another farmer, water quality did not necessarily take precedent over economics, but was nonetheless a consideration. "… if there was a practice that showed a great economic return, but yet resulted in … losing nutrients or, you know, something that was really bad for water quality, I would think twice about it." These examples add to the earlier examples of farmers identifying with ecocentric ideals such as Stewardship and deciding to do "the right thing to do" despite the lack of financial incentive. Together, they illustrate how ecologically oriented human-nature relationships inform decision making in spite of the prevalent bottom-line concerns of running a business.

CONCLUSION

As with the survey, interviews confirmed the hypothesis that farmers' human-nature relationship were unlike that of the broader populations studied in Europe. Unlike prior studies, the sample in this study did not reject the Master concept, and many informants were resistant to the Participant concept. However, the unstructured responses allowed for the emergence of themes and conditions specific to human-nature relationships in the agricultural context that speak to the unusual ways in which this population relates to nature.

Contextual factors such as financial constraints often necessitated certain aspects of the relationship, creating internal conflict between co-existing oppositional concepts within one individual. However, these constraints could be compatible with conservation practices, which in turn could be compatible with a variety of human-nature relationship types. These results further confirm the difficulty of categorizing individuals under one theorized human-nature relationship type, and provide some explanation for the weak association between respondents' relationship type and conservation.

CHAPTER 6

CONCLUSION

This study investigated human-nature relationships as a possible influencer of nutrient management practices of farmers in the Embarras watershed of east-central Illinois. A review of preexisting literature on human-nature relationships led to the conceptual framework of six relationship types and four hypotheses guiding the study: 1. Human-nature relationships can be characterized by multiple relationship types, 2. farmers relate to nature differently than the general population, 3. relationship types conceptualized to be more environmentally oriented associate positively with attitudes and behaviors regarding conservation, and 4. interest in conservation practices, willingness to adopt conservation practices, and engagement in conservation practices associate with human-nature relationships in this order, from strongest to weakest. This study set out to shed insight how farming populations in the US Corn belt relate to nature by focusing on a sample of farmers in the Embarras watershed. Through an ongoing project on nitrogen management, farmers in the Embarras watershed (including farm operators, landowners and managers) were interviewed in the spring of 2012, followed shortly thereafter by a survey of farm operators administered in the summer of 2012. This chapter will conclude the thesis with a deeper discussion of its findings, methodology and limitations. It will also expand upon the concept and typology of human-nature relationships for continued exploration.

FINDINGS

First, the multiplicity of ways in which people relate to nature was confirmed in both the survey and the interview. The vast majority (95%) of respondents agreed with more than one of the six statements. Moreover, the degree to which farmers identified with multiple relationship types that might be viewed as being fundamentally contradictory by preexisting literature (34%),

beckons for a fundamental reconsideration of the field's approach on human-nature relationships. For example, the Master and Participant types share an understanding of nature as powerful, and take different approaches. The Master focuses on the need to overcome their vulnerability to nature by exerting control. The Participant does not oppose nature's forces, but rather, accepts its superiority. The study thus revealed an unexpected proximity between the two furthest most concepts in the theoretical typology. Interviews also found concepts closer together to be intertwined. Not only was the hypothesis confirmed, these results suggest that the types themselves have fuzzy and overlapping boundaries.

The second hypothesis regarding the distinctiveness of farmers' relationship with nature was also confirmed. The most notable deviations of this sample from general public samples in past studies were the agreement of close to a third (28.7%) of the respondents with the Master statement and the low level of agreement with the Participant statement (69.1%) relative to the other ecocentric statements (88.3 – 90.4%). The interviews identified potential explanations for this deviance, most of which could be attributed to farmers' working relations with their land. As past studies have also pointed to the variations in human-nature relations by demographic, cultural and other characteristics, this finding calls for further investigation of the diversity of people's relationships with nature. Future studies may simultaneously investigate the fuzzy boundaries of the relationship types and the possible uniqueness and undiscovered diversity in human-nature relationships of unexplored populations.

The overall pattern of ecocentric relationship types associating positively with conservation attitudes and practices confirmed the main component of the third hypothesis. The interviews found that farmers' relationship with their land often involved a deep connection, generational succession, and resulting sense of responsibility that motivated them to take the

"best" care of the land that they could. Statistically, the Partner concept related most closely with conservation. Though unexpected, this finding was substantiated by remarks about collaboration and betterment in some interviews. The relative weakness of the link between the most ecocentric Participant concept and conservation is also surprising. As farmers have been known to dismiss their affects as personal and irrelevant to farm decision making (Herndl et al., 2011), one explanation may be that the extremity of the Participant concept indeed severed it from consideration in decision making. For the Steward and Ecosystem Service concepts, high levels of agreement with the statements may have not allowed for enough variation to yield significant results. Despite expectations, the Master hypothesis did not yield any significant associations with the conservation indices. Rather, interviews revealed ways in which the approach to take control over the land could be amenable to nutrient management efforts. Instead, apathy was weakly but negatively correlated with conservation interest. The emergence of the Partner concept as an important relationship type for conservation, and the possible compatibility of the Master concept and conservation may be additional ways in which farmers' relationship with nature differentiates from that of other population groups.

Finally, the study also supported the fourth hypothesis, that attitudinal measures of conservation would be more closely associated with the relationship types than actual behavior. Interview respondents augmented this finding with other decision making factors. Again, the more immediate link between farmers' livelihood and farm operations including nutrient management practices was highly influential here. The value of production, both to fulfill their role as providers of food to the still hungry world and to sustain an economically viable farm business was one consideration that arose in this context. Other factors addressed in the broader nitrogen management project include perceptions of water quality and familiarity with the

practices. The presence of such external decision factors to conservation adoption was expected, and reinstates the complexity of farm decision making and the need for the continued integration of the social sciences in addressing biophysical issues.

Methodology

The mixed-methods approach was a key and inextricable component of this study. Though not without limitations, the quantitative survey enabled access to a broader sample of farmer operators, while interviews engaged at deeper levels with community members. The measure for the human-nature relationship types was based on statements developed for this study and the available page space in the 12 page survey booklet. Compared to instruments used in other surveys of human-nature relationships, this is a considerably short measure and may not have captured the theorized types as comprehensively. Having only six items, ordered with some semantic relevance (from top to bottom: Master, Apathy, Partner, Steward, Participant and ES) may have also induced a sequencing effect.

Similarly, the conservation variables were taken from a preexisting design, and interest in conservation was taken from a two-part question on interest in new agricultural practices for production and for conservation (in this order). The conservation practices for both the willingness and behavior indices had been chosen for their relevance to nutrient management, rather than as indicators of engagement in conservation. As interviewees explained, most of the common practices made sense from a production standpoint. Some, such as variable rate application, require expensive infrastructure that may have inhibited smaller farmers from adopting them (Appendix B). This may have contributed to the observation that farmers often recognized the compatibility of their nutrient management practices with their production

interests, and may not be a strong indicator of their potential engagement in more altruistic forms of conservation.

The interviews, too, were conducted in the context of the broader project on nutrient management and were subject to certain limitations. The interviewer began as a novice, and the author of this thesis is an international student foreign to the Midwestern culture with little firsthand experience with the respondents. Interviews also require more contact and time of respondents and may be more prone to sampling bias. Most questions were targeted at the interviewees' decision making process, and the one targeted question regarding how they relate to nature was asked at the very end. Nonetheless, interviewees alluded to aspects of the relationship, and the consistency of survey and interview findings adds confidence to the accuracy of the respective findings. Moreover, the ability to compare survey and interview findings, add qualitative understanding to quantitative findings, and allow for additional themes to emerge out of the loose structure of the interviews was integral to the strength and depth of this study.

Causality cannot be inferred from the quantitative component of this study, and the degree to which human-nature relationships influenced conservation practices cannot be understood with precision even when interviewees referred to their relationship with nature as a source of motivation for conservation. Nonetheless, this study has largely focused on human-nature relationships as a motivation for conservation, and it is therefore important to note that the use of conservation practices may conversely influence this relationship. Coughenour (2003) described the way in which Kentucky farmers recognized the soil as having life through the practice of no-till. Much like this new frame of mind led to their development of a new social

identity, human-nature relationships and conservation practice may be understood as having mutual influence on one another.

Human-nature relationships

More fundamentally, the foreign and possibly controversial topic of relationship with nature posed challenges specific to this sample and at large. The refusal of nine respondents to answer the human-nature relationship questions at the end of the survey may have been a result of their dissociation from such concepts. An additional ten respondents responded but did not agree with any of the statements. Similarly, it is likely that the individuals who chose to take the time to fill out and return the survey, and who were willing to respond to an interview may have been more socially inclined, possessing strong feelings, or different from the broader population in other ways.

Due to the anticipated aversion towards concepts such as environmentalism and nature that were thought to be politically controversial amongst the farmers, the term 'nature' was generally avoided. In the survey, the umbrella question asked respondents to indicate their agreement with the six statements on their human-nature relationship "*regarding the land you own or farm."* The interview question was also tentative with the use of 'nature' and asked, "*How would you describe your relationship with nature in general or in this landscape?"* As a result, the framing of human-nature relationships in this study differed from the direct reference to 'nature' in other studies. Whether and how it was conceptualized by the sample is unclear, but may have influenced their responses.

Linguistic limitations are inherent in the construct of human-nature relationships regardless of word choice. A personal, subjective, and likely alien concept, it is difficult to tell

whether the terminology and concepts are understood equally by all respondents. For example, "nature" is a social construct often talked about as having different meanings for different people (Cronon, 1996; Freudenburg, Frickel & Gramling, 1995; Toogood, 2001). The same goes for "land" and "landscape," and thus the frame of reference regarding the relationship concepts may have been inconsistent amongst the sample. In fact, the concept of "human-nature" relationship already assumes a separation of humans and nature, as people must think of themselves in *relation* to a separate construction, of nature (Rehmann-Sutter, 2000).

While typologies render this nebulous concept more tangible for analysis, careful note of its limitations should be made. The findings confirmed expectations that relationship types were not mutually exclusive. The informants expressed relationships with their land that were oftentimes difficult to classify under one type, and the fuzziness of the concepts, if at all applicable to the relationship in question, may be lost in the seeming crispness of the categories. While this study sheds insight on the distribution of relationship concepts amongst the sample, the individuals' responses in the survey should not be taken as a definite and unchanging representation of their human-nature relationship. The interviews shed insight on the complexity of farmers' relationship with nature and characteristics of the relationship types as observed amongst this sample.

Characterizing the typology

As discussed earlier, the Master mentality may be based on a recognition of one's vulnerability to natural forces. The productive capacity of a famer's interaction with the natural environment may be particularly conducive to responses oriented towards overcoming this vulnerability through control. Again, this sense of control need not be oriented towards

environmental destruction, as had been previously theorized (White, 1967); agricultural conservation can benefit from increased control over natural processes.

Apathy was the most difficult construct to assess. It was mostly recognized as oblivion towards nature, however, there is no way to rule out the possibility that the interviewee simply did not allude to their relationship with nature in the interview. Alternatively, supposed lack of relationship or acknowledgement of nature as a possible object for a relationship may stem for a lack of awareness or knowledge. High levels of awareness regarding the nutrient management in this and other farming communities (Paolisso & Maloney, 2000) may be reflected in the low levels of agreement with this construct in the survey.

The Ecosystem Service concept was indicated as ecocentric both in the original concept and in the factor analysis. However, the interviews revealed how it could also be viewed as a relationship focused on nature's benefits rather than on nature. The character of this relationship type was often very practical.

Many respondents adhered with the Steward concept just as it was theorized. In this study's context of frequent multi-generational farming operations, regard for future generations came up frequently. One notion that was often present in the Steward type was a sense of pride and identity with the land, an additional motivation for cross-generational stewardship.

Notions of the original Partner concept such as collaboration and betterment of the land were also recognized in the interviews. Collaboration may further be characterized by the making of space for nature to do its part in the relationship. This sense of regard for natural functions of the farmland may have contributed to the close association between this concept and measures of conservation.

In this study's context, the Participant type often expressed itself as an acceptance of nature's superiority over humans. This contrasts with the sense of unity with nature that interviewees seemed to cherish in past studies (M. de Groot & van den Born, 2007). Indeed, it is conceivable that farmers in this study perceived of nature as a separate entity that they were not part of and were powerless against. While the interpretations here are inconclusive, future studies might consider this possibility.

RECOMMENDATIONS

A diversity of human-nature relationships was represented in both quantitative and qualitative components of the study, offering a range of potential approaches that may be effective in policy, outreach, and communication. While farmers' attitudes to government and regulation were beyond the focus of this study, findings suggested that some form of government intervention may be helpful in facilitating farmers' enactment of their desire to steward their land.

> Yeah, well it may cost up front but in the long run it saves. Any changes, it's gonna cost you money, not just money but time and effort and mental anxiety about your new thing. There's got to be a benefit there to make it all worthwhile, and the benefit could just that you are doing the right thing. I mean most farmers are pretty good environmentalists … most of them want to do the right thing and sometimes the do the right thing even if they make less money at it. … But long term, it's got to make economic sense too. A lot of programs that the government gets involved in will help support those kinds of programs because the public benefits from them, not just the farmer, but the public in general in terms of clear water, more wildlife, that sort of thing. That's why some of those programs, like CRP, are some of the better ways the government has spent money in the far

> program because a farmer know he would like to do the right thing but it's hard to do because you need to make a living as well. If the government just helped a little bit in terms of public money then, he'll go ahead and do it. To me that's a big factor of what's happened

This farmer believed in the environmental conscientiousness of farmers in general, but acknowledged obstacles to conservation such as money, time, and uncertainty. Noting the ecosystem services that would benefit the public at large, he was a proponent of government subsidies that encouraged conservation. The following informant gave further support for the use of subsidies, observing that farmers were generally eager to adopt conservation practices.

> We need to steady it, and you know, if we can come up with something that's relatively inexpensive, you know, not a big deal to install, economical, and the whole, you know. And it works, I think most people around here want to do the right thing … I just look around at all the buffer strips that have been put along rivers on both sides to keep erosion out, all the chemicals, or whatever is out there that might run in the river, people pretty well jumped on that because the government subsidized it a little. You didn't get rich signing up for that, but we all knew down deep that it's something you need to do. Well, if you come up with this tile outlet thing, and it worked just as good as our buffer strips did, I think people will buy it, I really do. But, we aren't to that stage yet. Nobody said this is the best thing we've ever seen, nobody really has ever seen it yet.

He observes that that a small subsidy was effective in promoting buffer strips, even if it did not make a practice any more profitable. This suggests that the invitational gesture might have been an important function of the government.

The internal conflict of many farmers may also explain the perceived effectiveness of governmental programs. If, as for many informants, farmers actually wish to engage in conservation efforts but are hampered by the logistical constraints, mere nudges from the government may be enough for their mobilization. As the Iowa farmers subdued the affective aspects of their relationship with nature as "private feelings," (Herndl et al., 2011) it is plausible that Illinois farmers also neglect their ecological ideals. The social climate of a community where "tree-huggers" are seen as outsiders with oppositional interests to the farm community may also encourage such suppression. Governmental support may provide the rational incentive to activate the affective aspects of farmers' relationship with nature.

Incentives for conservation would be expected to be inclusive in enticing farmers of various relationships with nature. Informants with an anthropocentric outlook on decision making did recount, for example, how highly erodible lands "earned points" in the CRP program. Farmers without preexisting inclinations towards conservation may also respond to such governmental measures. Future studies could verify the current effectiveness of governmental programs on this breadth of human-nature relationship types by examining whether enrollment is financially conducive to its enlisters.

CONCLUDING REMARKS

One of the major contributions of this study to the field of human-nature relationships is the proposition of the novel typological framework. A review of preexisting typologies led to a number of approaches that were combined for this study. The Visions of Nature working group's typology of the Master, Steward, Partner, and Participant types (W. de Groot, 1992), was expanded to encompass a lack of relationship, Apathy (Thompson & Barton, 1994), and the Ecosystem Services concept (Flint et al., unpublished manuscript). These types have not previously been combined, and the Ecosystem Services concept has not been empirically examined as a form of human-nature relationship. The added consideration of three dimensions of this relationship, positionality, character, and understanding (Flint et al., unpublished manuscript) that had also yet to be employed empirically further expands the field's conceptual framework for how people relate to nature.

Another contribution of this study is in its context. Despite their critical role in conservation efforts such as nutrient management (Schipper et al., 2010; Cho et al., 2010), much is still unknown about farmers' perceptions of their role on their land and how they negotiate trade-offs between profits and conservation (McGuire et al., 2012; Chouinard et al., 2008; NRC, 2010). The Mississippi River basin is one of the major contributors to the hypoxic zone in the Gulf of Mexico (Alexander et al., 1995; David et al., 2010), and within it, this study area in east-central Illinois has one of the highest nutrient loadings (Royer et al., 2006). The tile drainage system and high intensity production style in the area is representative of the upper Midwest region (Royer et al., 2006; Dinnes et al., 2002).This inquiry on farmers' relationship with nature addresses a demand for social science-based approaches to understanding the mechanisms and potential strategies for addressing the issue of hypoxia.

Moreover, this unique context was a major distinguishing characteristic of this study. The bulk of past studies on human-nature relationships has been conducted by the closely knit Visions of Nature scholars and based in Western Europe. Most of the literature reviewed focused on the human-nature relationships of the general public. Thus, this study by an unaffiliated scholar focusing on an unexplored population in a working relationship with the land adds considerable diversity and insight to the emerging body of empirical literature on human-nature relationships.

Morality of the relationship

Another aspect of previous works on human-nature relationships is the implied ethical superiority of some types over others. The Visions of Nature group presents the narrative that western countries had largely moved past an outdated Master concept at the root of environmental degradation (M. de Groot, 2012). A philosopher commented on his personal, moral unease with view of nature as a machine, which legitimized its exploitation (Rehmann-Sutter, 2000). In a certain respect, this view is understandable. The current status of environmental issues are clear indication that something needs to change, and empirical studies, including the present one, has linked anthropocentrism with a lower levels of conservation orientation. Nonetheless, this study also sheds insight the uniqueness of farmer's working relationship with nature, which distinguishes them as a population from the urbanizing general public. It also shows ways in which anthropocentric orientations can be compatible with conservation efforts, and readers should be cautioned against a value-laden interpretation of the human-nature relationship concepts.

Farmers' understanding of nature

In a similar vein, farmers may have relationships with nature more similar to the general public with regard to lands that they do not have a working relationship with. After all, the distinctiveness of their relationships is driven by constraints and considerations unique to their role not only as a caretaker but also a producer on their farmland. While their occupation may have pervasive influences on their human-nature relationship, the relationship is theorized as being influenced by the environmental and social contexts (Flint et al., unpublished manuscript). It is conceivable that farmers' human-nature relationships may more closely resemble the general public when asked about recreational lands that they do not own.

Indeed, the "nature" that farmers conceptualize of may indeed be distinct from that of the general public. In other words, it is conceivable that farmers relate intimately with a larger piece of land than other groups are accustomed to. Just as suburbanites might consider their lawn a part of their home and not look for "nature" in it, farmers may not see "nature" on their farmland. A suburban environmentalist may be a meticulous lawn keeper and strive for absolute eradication of weeds. The farmer may do the same in his field. The two may share a love for outdoor activities, or seek out "nature" in national parks or other, large-scale areas of perceived wilderness. However, tension would arise if the suburbanite expects all landscapes to embody their concept of nature. They may therefore criticize farmers for intensive agricultural practices while seeing no issues with similarly intensive lawn care. In reality, the picture is likely more complicated, as farmers have shown unique preferences also in landscape aesthetics. One study of Dutch undergraduate students found that agricultural students contrasted with students from other disciplines in considering agrarian landscapes to be natural (van den Berg, 1999). Nonetheless, the scale at which farmers tend the land is unique, and may play some role in

differentiating farmers' human-nature relationships from other populations'.

If, as prior studies have shown, the Embarras watershed is indeed one of the greatest sources of nitrogen loading towards the hypoxic zone in the Gulf of Mexico (Royer et al., 2006), it is noteworthy that the interviewed farmers generally considered themselves to be stewards of their land. Many informants also considered themselves to be smaller and more conscientious in their practices than "large" scaled operators. This presents a curious disconnect between these farmers' self-perceptions and their detrimental impact on the land. Prior studies suggested that the availability of information was not an important constraint (Peterson, 1991), and many farmers indicated their awareness of the fact that they were receiving much of the blame for the hypoxia. Further studies may target those operators that the informants in this study viewed as lacking care in their land management, or compare the perceptions and practices of Embarras watershed farmers to larger farm operators with lower levels of nutrient loading. Alternatively, a more in-depth investigation of this sample may identify other factors that lead to the high levels of impact seen in the study area despite the purported stewardship of the sample, thereby facilitating the development of effective policy and management approaches. After all, the overarching finding that the farmers in this study were interested in stewardship of their land sheds great hope for future progress.

It is hoped that the insight from this study will benefit the sample community itself. Hypoxia in the Gulf is an increasing societal concern, and as one of the actor groups in the chain of actions leading to eutrophication, the farmers in this study are subject to top-down pressure to mitigate their nutrient runoff. Enabling policy makers to better understand farmers and their various internal process of decision making may increase the likelihood of more effective and amenable policies that take the farmers' perspectives in to consideration.

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APPENDIX A. 'BEST' MANAGEMENT PRACTICE

Practically speaking, a number of issues complicate the use of actual practices as the only variable for conservation. As the following section explains, there is no such thing as a universal best management practice (BMP) (Nowak & Korsching, 1998). With regard to nutrient management, nitrate leaching results from a combination of factors such as site characteristics and practices and requires a combination of approaches for sufficient mitigation (Dabney, Delgado, Meisinger, Schomberg, Liebig et al., 2010; Dinnes et al. 2002). To complicate matters further, the effect of the recommended nutrient management techniques can also vary by site and application (Hamlett & Epp, 1994; Lambert, Schaible, Johansson, & Vasavada, 2007).

"Conservation behavior" is a difficult term to define (Nowak & Korsching 1998). Optimal practices must take into consideration the objectives and site conditions (Hamlett & Epp, 1994; Environmental Protection Agency [EPA], 2003; Lambert et al., 2007) which may be addressed through the use of regular soil tests (EPA, 2003; NRC, 2010). Consideration of site specific conditions can help design appropriate nutrient management plans (NRC, 2010), identify recommended fertilization rates (EPA 2003; Hamlett & Epp, 1994; Williams, Crozier, White, Sripada, & Crouse, 2007), and increase the precision of fertilizer application through variable rate application (Grisso, Alley, Thomason, Holshouser & Roberson, 2011).

Practices for the mitigation of nitrogen from agricultural runoff include the use of winter cover crops (NRC, 2010), buffer strips (Follett et al., 2010; Lowrance, Dabney & Schultz, 2002; EPA, 2003), and conservation tillage (i.e. reduced or no-till) (NRC, 2010; Makowski, Sofranko, & van Es, 1990; Follett et al., 2010). Further, the installation of drainage water management techniques that give farmers control over the water table in the field, bioreactors that intercept the runoff with a filter (Cooke, Sands, & Brown, 2008), and wetlands (NRC, 2010; Dinnes et al.,

2002; EPASAB, 2007) are not as widely known or adopted, yet gaining attention for their potential in addressing nutrient management issues.

However, it is critical to recognize that the same practices can have varying and even detrimental environmental impacts depending on the biophysical context (Nowak & Korsching, 1998; Nowak, Bowen & Cabot, 2006). For example, a bioreactor can result in adverse effects when misused (Schipper, Gold & Davidson, 2010). While reduced tillage is generally purported to be beneficial to the soil and water quality (NRC, 2010; Makowski et al., 1990; Follett et al., 2010), the benefits are contested, as by one study that claimed no-till could actually increase the nutrient runoff by impeding the integration of fertilizer into the soil (Zeimen, Janssen, Sweeney, Pierzynski, Mankin et al. 2006). In artificially drained lands, conservation tillage and buffer strips are said to be ineffective in mitigating the nutrient loading of the tile water (Dinnes et al., 2002; Nassauer, Corry, & Cruse, 2007). As such, BMPs can have unintended or reduced impacts (Gassman et al., 2010; Nowak, Bowen & Cabot 2006) or involve the trade-off of one improvement for a detriment (NRC, 2010; Zeimen et al., 2006).

Heterogeneity in the application of the same practices must also be noted. Discrepancies in the actual implementation, such as management style, compliance with recommendations, misuse, and other individual differences can lead to varied results (Schipper et al., 2010; Nowak & Cabot, 2004). Moreover, adoption is not a dichotomous concept but a gradual process (Nowak & Korsching, 1998), leading to the use of both attitudinal and behavioral measures of farm practice in this study.

APPENDIX B. CONSERVATION PRACTICES

This section reviews conservation practices and their effectiveness for nitrogen management. The first eight are relatively common or well-known practices. The last three management techniques are still new and not as widely known or adopted, yet gaining attention for their potential in addressing nutrient management issues. While it is hoped that the hypoxic zones in the Gulf might be addressed through such practices (NRC, 2010), it is also known that there is no silver bullet. A combination of techniques will likely be required to sufficiently reduce nitrate loadings (Dabney et al., 2010).

Regular soil tests

As soil conditions vary by site, optimal management techniques must take into consideration the site-specific condition (Hamlett & Epp, 1994). Soil tests are recommended practice by governmental programs (EPA, 2003) and help determine the necessary rate of fertilizer application (NRC, 2010). Napier and Tucker (2001) found that close to half of their respondents in Iowa tested once every 3 years, and that only 2% had never conducted a soil test. Frequencies were lower amongst their sample of farmers in Ohio and Minnesota, where 10% had never tested.

Nutrient management plan

Nutrient management plans are comprehensive plans and increasingly adopted to facilitate compliance with water quality standards. They are typically based on soil tests, a realistic yield goal, an assessment of nutrient sources, and an assortment of best management practices (BMP) (NRC, 2010).

Recommended fertilization rates

University extension services are amongst some of the institutions providing fertilizer rate recommendations to farmers. Using a realistic yield goal following site-specific recommendations for appropriate timing, application rates and methods have been critical to reductions in nitrate leaching (EPA 2003; Hamlett & Epp, 1994; Williams et al., 2007)

Variable rate application

Variable rate application (VRA) further customizes practices to site conditions by adjusting the rate at which chemicals are sprayed in the field (Grisso et al., 2011). So far, the adoption rate of VRA for nitrogen fertilizer has been extremely low despite its potential economic and environmental benefits (Grisso et al., 2011; Ruffo, Bollero, D. Bullock, & D. Bullock 2006). Possible explanations for this low adoption rate may be that recommended rates often contradict the established management beliefs (Grisso et al., 2011), and that savings in fertilizers are not enough to economically justify the high costs of the necessary equipment (EPASAB, 2007). Nonetheless, precision agriculture is also said to be compatible with a production orientation because it does not take land out of production (Nassauer, Corry, & Cruse, 2007).

Winter cover crop

Cover crops serve multiple purposes, such as preventing soil erosion, reducing weeds, and facilitating the uptake of nitrogen for subsequent crops (NRC, 2010). Winter cover crops further reduce nitrate leaching by absorbing the available nitrates in the soil after harvest and during the off-season when most leaching is apt to happen (EPA, 2003; Follett et al., 2010; Dabney et al., 2010; Dinnes et al., 2002).

Despite their well-documented effectiveness, cover crops are not widely planted (NRC, 2010). Even though the vast majority of Corn Belt farmers in a study by Singer, Nusser, and Alf (2007) believed that cover crops effectively reduced soil erosion (96%) and increased soil organic matter (74%), only 18% had actually used them. Some concerns that have inhabited the adoption of cover crops include possible decrease in yields (Dinnes et al., 2002), possibility of encouraging pests, and seeding costs (NRC, 2010). The fact that 56% of the Corn Belt farmers in the aforementioned study indicated willingness to plant cover crops if cost-sharing were available speaks to the importance of the financial constraint (Singer et al., 2007).

Buffer strips

Buffer strips, also known as filter strips, are riparian buffer zones intended to intercept the runoff from agricultural lands to bodies of surface water. There is a general consensus that this practice mitigates the runoff of nitrogen by removing sediment, organic matter, and other pollutants from agricultural waste waters (Follett et al., 2010; Lowrance et al., 2002; EPA, 2003). However, this effectiveness is true mainly for shallow ground water and may be ineffective for mitigating tile water (Dinnes et al., 2002).

Conservation Tillage (Reduced or no-till)

According to the National Research Council (2010), conservation tillage is "any tillage and planting system that leaves 30 percent or more of the soil surface covered by crop residues after planting to reduce soil erosion by water" (p. 86). Sources say that no-till is popular for not taking agricultural lands out of production and widely adopted (Nassauer, Corry, & Cruse, 2007). Purported benefits include reduced soil erosion and water runoff, increased soil water retention, and reduced soil degradation (NRC, 2010; Makowski et al., 1990), and reduced tillage is understood as reducing nitrate losses associated with the sediment and surface water runoff

(Follett et al., 2010). Nonetheless, other studies note tillage as not being very important for nitrate loss (Dinnes et al., 2002), and that no-till would not impede the flow of tile runoff (Nassauer, Corry, & Cruse, 2007). Some even contradict its benefits, saying that no-till reduces the integration of fertilizers into the soil and thus allowing for more runoff of nutrients (Zeimen et al., 2006).

Drainage water management

The next three reactive techniques of reducing nitrate leaching have been introduced relatively recently. The first, drainage water management (DWM), is also referred to as controlled drainage or water table management. It implements a structure at the end of the tiles that allows farmers to control the water levels in their fields (Cooke, Sands, & Brown, 2008). DWM generally reduces outflow from tile drainage systems, thereby reducing the nitrate loadings onto surface water systems. Drainage researchers have reported a conservative estimate of a 30-40% reduction in average annual nitrate loadings (Cooke et al., 2008). It is said that there is little risk of loss in yields (NRC, 2010), and potential for increased yields (Fang, Malone, Ma, Jaynes, Thorp et al., 2012). This technology is fairly new, and there are no reliable estimates of adoption rates in the Midwest. However, implementation costs are on par with what Illinois farmers pay for other technology, and DWM systems are gaining popularity (Cooke et al., 2008; NRC, 2010).

Bioreactor

The second technology, the bioreactor, is a bank of carbon source (such as woodchips) that breaks down the nitrates in the water before they enter into the surface water (Cooke et al., 2008). One study in East Central Illinois reported a 33% reduction in nitrogen loadings using a bioreactor (Woli, David, Cooke, McIsaac, & Mitchell 2010). The flat topography of this area is

suitable to bioreactors, and researchers report advantages such as low maintenance and not needing alterations to practices or productive lands (Cooke et al., 2008).

Wetland

Finally, wetlands have been known for a wide range of benefits including the removal of contaminants such as nitrogen and phosphorus (NRC, 2010, Dinnes et al., 2002). Large-scale reviews of the nitrogen removal strategies often remark that wetlands are critical to the effort (NRC, 2010), and the EPA Scientific Advisory Board (2007) identified wetland restoration as one of five top opportunities for nitrogen reduction. This group further recommended concentrating on the extensive row-cropped and tile-drained Corn Belt, and the effectiveness of wetlands in the Embarras watershed has been previously observed (Zucker & Brown, 1998). Yet, despite its high effectiveness, the wetland restoration is inhibited by its dependency on site and climate and cost, in money, productive land, and effort (NRC, 2010; Woli et al., 2010).

While the above practices represent conservation practices relevant to nitrogen management, it should again be recognized that none of the strategies provide a comprehensive solution (Dabney et al., 2010; Dinnes et al. 2002). Nitrate leaching is a result of a variety of management and site characteristics, and requires a combination of conservation techniques.

APPENDIX C. INDICATORS OF CONSERVATION

This study used items from a survey designed for a nutrient management project as indicators of conservation. Controlling for other factors influencing the adoption of conservation was beyond the scope of this study. However, the compatibility of practices with production motives, their suitability for respondents' lands, and respondents' knowledge of the practices are some of these factors acknowledged as having had potential influence on farmers' conservation practices.

First, not all practices were equally conducive to high production levels. While cover crops incur costs and are not widely planted (Appendix B), others are understood to be compatible and even helpful for conservation and are more commonly adopted. Conservation tillage and precision agriculture, or variable rate application, take no land out of production (Nassauer, Corry, & Cruse, 2007). Drainage water management is also said to incur little risk in yield losses (NRC, 2010), but have potential for increased yields (Fang et al., 2012). The cost of infrastructure may have been a greater inhibitor, explaining the positive association between farm size and the conservation practice index in this study (Appendix G).

Site compatibility may have also influenced responses. For example, while wetlands are said to be a critical component of wide scale nitrogen management (NRC, 2010; EPASAB 2007), its dependency on certain site characteristics as well as the effort and resource commitment it requires have inhibited their restoration or installation (NRC, 2010; Woli et al., 2010). Farmers who indicated their unwillingness to try this nitrogen management technique may have been aware of the inappropriateness of this practice for their site.

Third, knowledge of the practices at hand may moderate the manifestation of intention as practice or preference, as illustrated by a study on river management preferences in the Netherlands. Theoretically, respondents identifying as Stewards would prefer an ecologically sound management approach, which in this case involved cutting down trees. However, most Steward types opted against the cutting of trees, and the researchers speculated that the respondents must have been unaware that it was actually the "most natural" management style (M. de Groot & W. de Groot, 2009, p.3). Lack of information or misinformation may play a role in the adoption of agricultural practices as well, especially for relatively recent technologies such as the bioreactor.

APPENDIX D. TYPOLOGY OF HUMAN-NATURE RELATIONSHIPS

To explore the typology created for this study, a series of tests were run to see how closely the human-nature relationship constructs related to one another, and whether or not each statement was statistically discernible as being distinct from the others. This procedure led to experimentation with a possible categorical relationship variable. Given the non-normal distribution of the concepts, the first step was to create a correlation matrix of Kendall's τ to examine the interrelations amongst the concepts.

The correlations are largely consistent with the theoretical conceptualizations and previous findings on the typology (Table 4). First, the Partner and Steward types are most highly correlated (τ =.784, p=.000), supporting their empirical history of at times being found to be undistinguishable from one another (W. de Groot & van den Born, 2003; Hunka et al., 2009). Second, correlations amongst the ecocentric concepts are positive and for the most part, consistent with theory. There is a slight discrepancy with the theoretical scale from ecocentrism to anthropocentrism (Zweers, 2000) in that the Participant concept correlated slightly more strongly with Steward τ=-.646, p=0.000 than with the more ecocentric Partner τ=-.606, p=0.000. However, the new Ecosystem Services concept, which theoretically is more anthropocentric than the three correlates strongest with the least ecocentric Steward τ=-.656, p=0.000, next with Partner, τ=-.623, p=0.000, and least of the three with the Participant, at the end of the spectrum τ=-.601, p=0.000. As for Master and Apathy, correlations with other concepts are non-significant with the exception of Apathy and Steward (τ=-.20, p=0.021), supporting the notion that these concepts are distinct from the others. This significant correlation between Steward and Apathy was unexpected, but its negative coefficient is consistent with the theoretical dispersion of these two concepts.

Table 4. Correlation matrix of human-nature-relationship types

		Master	Apathy	Partner	Steward	Participant
Apathy	τ	0.098				
	p	0.239				
	n	103				
Partner	τ	-0.017	-0.155			
	p	0.837	0.071			
	n	103	103			
Steward	τ	-0.043	**-0.201**	**0.784**		
	p	0.609	0.021	0.000		
	n	102	102	103		
Participant	τ	0.033	-0.152	**0.606**	**0.646**	
	p	0.689	0.074	0.000	0.000	
	n	102	102	103	103	
ES	τ	0.044	-0.046	**0.623**	**0.656**	**0.601**
	p	0.604	0.597	0.000	0.000	0.000
	n	102	102	103	102	102

*Correlations significant at p=.05 are boldfaced.

Past typologies have evolved over time with varying numbers of concepts, and given the addition of two novel constructs in this study, further tests were run to confirm whether the relationship items could be statistically distinguished from one another. Friedman's ANOVA confirmed that indeed there were significant differences amongst the types. A series of Wilcoxon Signed Ranks tests then tested statistical differences between each combination of two types. The results indicated that agreement with the Partner, Steward and Ecosystem Services concepts in this survey were not statistically discernible from one another (Partner and Steward, z = -0.043, *ns*, r = -.004, Partner and Ecosystem Services, z = 0.000, *ns*, r = 0.000, and Ecosystem Services and Steward, z = -0.0128, *ns*, r = -0.013).

Friedman's ANOVA, Wilcoxon Signed Ranks tests and the factor analysis indicated that a number of the human-nature relationship items from the survey responses were statistically indistinguishable from one another. However, there was disagreement between the initial

Wilcoxon Signed Rank tests and the factor analysis, in that the former distinguished responses to the Participant statement from those associated with the Partner, Steward, and Ecosystem Services types, while the latter grouped all four variables as one construct. This result, that the Participant would be the most differentiated of the ecocentric concepts, is understandable given the distribution of the responses as well as the fact that the Participant concept is on the far end of the theoretical spectrum of ecocentrism (Zweers, 2000). Further, it is not surprising that items would factor together, as each variable was measured by only one item. Relative to Master and Apathy, the other four are all considered ecocentric.

Nonetheless, the clustering results suggested experimentation with combining the six types. Two new aggregate variables accounted for results from the Wilcoxon Signed Rank tests and the factor analysis. Subsequent analyses tested all three variations of the human-nature relationship variable assemblages to monitor if the aggregation led to different results: 1. all six original types, 2. four types, combining Steward, ES, and Partner variables (SEP, M=4.1, Mdn=4.125, $D(102) = 0.227$, p=.000), and 3. three types, using a combination of Steward, ES, Partner, and Participant (SEPP, M=4.02, Mdn=4.13, $D(102) = 0.179$, p=.000). Combination variables were computed as an average of the responses to each included statement

HNR x CSV: Experimentation with a categorical relationship variable

The initial Wilcoxon and factor analyses of the human-nature relationship items suggested an aggregation of the ecocentric human-nature relationship items. While the study aims towards a more nuanced understanding of how people relate to nature than the popular ecocentric-anthropocentric dichotomy, the test results and the nascence of the Visions of Nature typology called for experimentation. As with willingness, several variations of categorization were attempted. For example, to capture the overall pattern of responses on the six items, one

starting point was to compare respondents score on the Master item and the SEPP average of all ecocentric items. As most of the SEPP items were commonly agreed with (Figure 7), the categorization necessitated a parsing of respondents by their alleged degree of ecocentrism. The multiple agreements of the survey responses complicated this procedure greatly. Nonetheless, a number of systematic categorizations synthesized the six items in to one human-nature relationship item with two to three categories. One way ANOVA tests were run with interest and practice, respectively. Additionally, these variables were reduced to two categories (1 to 3 and 4 to 5) to enable chi-square analyses. None of the results with the categorical human-nature relationship variable and the interest, practice, and willingness variables were significant. Both the procedure of attempting to categorize respondents as one of two or three relationship types and the non-significant yields substantiate the hypothesized multiplicity and complexity of people's relationship with nature.

APPENDIX E. LINEAR REGRESSION

A linear regression further assessed the association between the human-nature relationship concepts and conservation variables. While correlation and chi square analyses assessed the association between a conservation variable and one of the relationship statements, regression analysis incorporates responses on all relationship items. This accommodates the overall pattern of a farmer's responses, and the relative strengths of their agreement or disagreement with the respective relationship types. The regression analysis revealed that human-nature relationship items explained the greatest variation in the conservation indices when using the respondents' responses to the six original types as independent variables rather than combined variables clustering three or four types together. Combined, the six items explained 14.1% of the variance in conservation interest after adjusting for sample size (p=.002) (Table 5). Only Partner had a significant association with the dependent variable, at β=0.443, p=.032. Additionally, as the residuals were not normally distributed, $D(91) = 0.95$, p=0.042, the results cannot be generalized beyond the sample.

Table 5. Regression results for human-nature relationship and interest

	β	t	p
Constant		5.639	.000
Master	.000	.004	.997
Apathy	-.061	-.644	.521
ES	-.093	-.524	.601
Steward	-.156	-.829	.409
Partner	**.443**	**2.177**	**.032**
Participant	.232	1.527	.130
Adjusted R^2 = .141, $F(6,93)=3.707$, p=.002			

Regression analysis was also run with the number of adopted conservation practices as the dependent variable. The six human-nature relationship items explained 12.3% of the variance

in practices (p=.006, Table 6). The Partner item was the only one with a significant Beta, .468, p=.028, indicating that the other items did not increase the accuracy at which responses on human-nature relationships might be used to approximate conservation behavior. The assumption of normality was again violated, $D(91) = 0.122$, p=0.002.

Table 6. Regression results for human-nature relationship and behavior

	β	t	p
Constant		1.859	.066
Master	.021	.221	.826
Apathy	.171	1.778	.079
ES	-.050	-.261	.794
Steward	-.303	-1.577	.118
Partner	**.468**	**2.239**	**.028**
Participant	.207	1.315	.192
Adjusted R^2 = .123, $F(6,92)=3.293$, p=.006			

Again for comparison, a regression was run for willingness despite the non-significant correlation results and its categorical data type. Not surprisingly, none of the models yielded significant results and had very low, even negative explained variances. Overall, these results indicate that the farmers' responses on the human-nature relationship items in the survey explained 12% of the variation in their reported practices and 14% of the variation in their interest in conservation practices. The relative strengths of the interest and practice variables are again consistent with the hypothesis that interest would be more closely associated with behavior.

A closer look, however, shows that many of the concepts were not contributing significantly to the explained variance. Partner, in fact, is the only relationship type with a significant beta on either result (Interest β=.443, $t(93)=2.177$, p=.032, Behavior β=.468, $t(92)=2.239$, p=.028). When running a regression with Partner as the only independent variable, the regression model for interest is positively affected (Adjusted R^2 = .141, $F(1,101)=17.747$,

p=.000), while as the model for practice loses explained variance (Adjusted R^2 = .093, F(1,100)=11.406, p=.001). Yet, across these cases, the regression results show weak to moderate links between the farmers' agreement with the human-nature relationship concepts and their responses on the conservation indices. The survey data thus suggest that there may be other factors informing farmers' decision making that complicate the manifestation of their relationship with nature as the respective attitudes and practices regarding conservation that would were expected in the theoretical framework.

APPENDIX F. FARM AND FARMER CHARACTERISTICS

Survey respondents were asked a series of questions about themselves and their farm. This section overviews these variables and results of tests controlling for their influence on the link between the human-nature relationship types and conservation indices. Demographic questions about the farmers included their birth year, sex, education and farm income. Education was asked as a five-point multiple choice question (1=*some high school*; 2=*high school graduation or equivalent*; 3=*some college or technical degree*; 4=*college degree;* 5=*post-graduate college training or degree*). Farm income was a six-point question (1=*less than $10,000*; 2=*$10,000 to $49,000*; 3=*$50,000 to 99,999*; 4=*$100,000 to $250,000*; 5=*$250,000 to $499,999*; 6=*more than $500,000*), and an open-answer question asked about the proportion of respondents' personal income that came from farming activities. The survey also asked for the number of years the respondent had been involved in farming (open answer), whether or not the farm had been owned or operated by a family member prior to the respondents (0=*No*; 1=*Yes*), and how likely they thought it was that a family member would continue the operation (1=*Will not happen or unlikely;* 2=*likely*; 3=*I don't know*). Finally, farm size and percentage of owned land was computed based on a question inquiring the number of farm acres the respondent had inside and outside the Embarras watershed, and whether they were cash-rented, crop-shared, or owned. All acreages were summed for the total acreage owned or farmed by the respondent. These demographic variables were checked for significant correlations or chi square statistics with the relationship types and conservation indices, and if significant, entered into the regression as controls for the linkage between human-nature relationship and conservation.

For chi square analyses, all of these data except for sex (*n*=109; 1=*male* (96.3%); 2=*female* (3.7%)), inheritance (*n*=107; 0=*No (*not from family *(*16.8%); 1=*Yes* (Farm operation

previously owned or operated by family member) (83.2%)) and expected succession (*n*=108; 1=*Will not happen or unlikely* (21.3%); 2=*Likely* (56.5%); 3=*I don't know* (22.2%)), which were already two or three category answers, were re-categorized into two to three categories. Age (*n*=106; 1= *up to 59 years old* (49.1%); 2=*60 or older* (50.9%)), percent of income from farming (*n*=102; 1=*up to 89%* (47.1%), 2=*90% of more* (52.9%)), years of farming (*n*=107; 1=*up to 39 years* (48.6%); 2=*40 years or more* (51.4%)) and the percent of land rented (*n*=108; 1=*up to 81.89%* (50%); 2=*81.9% or more* (50%)) was split into two categories at the median. Education (*n*=108; 1= *high school or less* (25%); 2=*some college* (39.8%); 3=*college degree or more* (35.2%)), and income (*n*=92; 1=*up to $99,000* (22.8%); 2=*$100,000 to $250,000* (30.4%); 3=*$250,000 or more* (46.7%)) were split into three categories. Farm size was split at 500 acres (*n*=113; 1= *up to 499 acres* (47.8%); 2=*500 acres or more* (52.2%). Wherever there were enough data, correlation and chi squares analyses were run for the above variables with each relationship type and conservation index.

Only few of the human-nature relationship types had significant links with demographic or farm characteristics. Respondents who agreed with the Master statement were likely to have lower farm incomes (χ^2 (2, *N*=87) = 6.05, *p*=.049, *V*=.264), and less likely to have continued the operation from family members (τ=-.264, *p*=.003). Respondents who agreed with the Apathy type were more likely to be older (χ^2 (1, *N*=100) = 4.21, *p*=.040), male (τ=-.180, *p*=.049), long-time farmers (χ^2 (1, *N*=101) = 3.938, *p*=.047, *V*=.197), who had not taken over the farm from family (τ=-.180, *p*=.049) and did not expect family members to continue the farm (τ=-.184, *p*=.031). Additionally, farmers who agreed with the Participant statement were generally older (χ^2 (1, *N*=100) = 4.42, *p*=.035, *V*=.210; τ=-.158, *p*=.040). Steward, Ecosystem Services, and Partner items had no significant correlation or chi square results. As for conservation, those who

engaged in greater numbers of common practices were more likely to have higher incomes (χ^2 (4, N=91) = 13.69, p=.008, V=.274; τ=-.235, p=.007), be more educated (χ^2 (4, N=106) = 10.212, p=.037, V=.219), and have larger sized farms (χ^2 (2, N=109) = 17.215, p=.000, V=.397; τ=-.231, p=.002). Interest was likewise associated with higher levels of income (χ^2 (2, N=90) = 16.35, p=.000, V=.426), although this test was only statistically significant when interest was categorized differently than how it was used in the analysis with relationships (1=1-3; 2=4-5 on a 5-point scale). Also, note that the correlation and chi square analyses did not always agree with each other, as all significant results have been reported here. Tenancy and proportion of income from farming were not significant in their statistical associations with the relationship or conservation variables.

The follow-up regression where any effect of controlling these demographic and farm characteristic variables might be expected would be for conservation practice, which was the only conservation index with a significant correlation with any of these variables. Further, the Partner item was the only relationship type that had a significant Beta on the previous regressions, but had no significant correlations with the demographic and farm characteristics. Thus, as before, the original interval variable for the number of common conservation practices was entered into a linear regression with the six relationship types, but with an addition of the 6-point income categories and continuous total farm acreage variables (Table 7).

Table 7. Regression results for human-nature relationship, income, farm size and behavior

	β	t	p
Constant		-0.081	0.935
Master	0.073	0.703	0.484
Apathy	0.179	1.808	0.075
ES	0.011	0.052	0.959
Steward	-0.379	-1.985	0.051

Partner	**0.53**	**2.512**	**0.014**
Participant	0.097	0.582	0.562
Income	0.211	1.844	0.069
Acreage	0.187	1.677	0.098

Adjusted R^2 = .216, $F(8,76)=3.900$, $p=.001$

The resulting model explained a heightened proportion, 21.6% of the variance. While a number of items came close to the significance level, Partner was again the only item with a significant Beta ($\beta=.530$, $t(76)=2.512$, $p=.014$). Finally, while all variance inflation factors (VIF) are under 10, one threshold for multicollinearity (Field, 2009), earlier analyses had indicated the similarity of the ecocentric relationship types. Another regression was run with Partner as the only relationship type (Table 8).

Table 8. Regression results for partner, income farm size and practice

	β	t	p
Constant		0.738	0.463
Partner	**0.292**	**2.926**	**0.004**
Income	0.221	1.972	0.052
Acreage	0.158	1.407	0.163

Adjusted R^2 = .171, $F(3,81)=6.762$, $p=.000$

However, the explained variance fell to 17.1% and Partner remained the only significant contributor to the model ($\beta=.292$, $t(81)=2.926$, $p=.004$). These results indicate that while a number of demographic and farm characteristics were linked with the relationship and conservation variables, none of these explain the heterogeneity in farmers' relationships with nature or in their attitudes and practices of conservation.

APPENDIX G. LAND OWNERSHIP AND SIZE

Farm characteristics emerged out of the interviews as an additional factor influencing the operator's relationship with the land and engagement in conservation practices. Ownership of the land was thought to influence both interest and the logistical feasibility of conservation practices. Informants also shared their perspective that large-scale farmers and absentee landowners would lack the intimate relationship with the land that they often claimed they had. Notably, neither of these perceptions was supported in the quantitative analysis.

Tenancy

According to informants, tenancy was an important factor influencing farmers' relationship with their land. Renting placed both logistical and affective constraints on conservation. Renting was conducive to a more short-term focus, financially restricted farmers' ability to invest in conservation practices, and posed additional pressures to produce high yields. The first excerpt is from a farmer whose own land had been in his family for over a century.

> ...With a cash-rent situation, you're renting the ground year to year, with usually no security… You could easily lose that ground next year or the year after. So you tend to farm it—you're gonna look at it in the near term. And I think sometimes that—without a long term look at things, that's certainly gonna adjust how you go about farming it with respect to how you fertilize it, even the conservation plans that you use on it. The ground I have has been in—two thirds of the ground I farm's been in the family over a hundred years. We're approaching 150 years, so I'm the third generation on it. So that land means a little more to us with respect to how we take care of it, and we kind of expect it to stay in the family. So it's

> just like—it's like our home, more than just a business. That's where we make money.

He speculates that farmers on rented lands focus on the short-term, explaining that cash-renting farmers were farming from lease to lease and more vulnerable to fluctuations in their income. Others supported this farmer's perspective, that "[renting] gives all the burden onto you if you have a bad year, you absorb the whole bad year," though on good years, cash-renters "[are] kind of your own boss, you can do what you want to do on that farm." This links back to the overarching concern of the bottom-line, suggesting that certain tenancy patterns may compound farmers' vulnerability to yearly fluctuations in natural conditions. Theoretically, the vulnerability, coupled with the pressure to perform economically, places farmers in opposition to nature's fluctuations. This Master-type oppositional relationship may further the potential for temporary tenancy patterns to lead to a prioritization of yields over long-term conservation.

Being a tenant as opposed to a landowner was said to diminish interest not only in the long-term performance of the land, but also in the adoption of conservation practices. One farmer explained the technical complications of covering the cost of water quality improvement on rented lands. "[W]ho's going to pay for that? " he asked, supporting the notion that farmers on rented lands may be less inclined to compromise their immediate yields for long-term soil or water quality improvement. In a 2008 study of 3,500 active farmers in four Midwestern states including Illinois, 45% of respondents used cover crops on their own land, while only 14% used cover crops on rented land (Singer). This gap in land management practices on rented and owned lands is noteworthy, as 68% of survey respondents in the study area indicated that they rented the majority of their land.

Moreover, the linkage between tenancy and inclination towards conservation is consistent with the generational aspect of the Steward concept, whereby the sense of responsibility is felt towards future generations. In other words, farmers who do not expect their own children to be impacted by their practices may feel less obligated to engage in conservation. In the survey, 57% of respondents expected a family member to succeed their operation, but coupled with the large percentage of farmers who also rent the majority of their land, suggest that tenancy may not necessarily determine the succession of a farming operation. Nonetheless, it is important to note the theoretical support for the possible association between conservation motivated by the Steward concept and tenancy patterns of the individual's operation.

Another suggested restriction to a tenant's adoption of conservation practices is the added pressure to perform to their landlord's expectations. The economic pressure on landowners themselves verifies that they may be inclined to pass the pressure on to their tenant. "To pay the property taxes I have to pay, we have to make a profit, you know, or else you lose the land. So what's the point? You've got to make money. " This provides some explanation for the predicament the following farmer describes regarding experimentation with alternative practices.

> …you've got to be committed. Your equipment, your planter, has to be done right, set up right, or you're destined to fail. You are absolutely destined to fail. If you aren't committed, and farmers are going to have to have some help because they can't take their planter and outfit it for twenty of forty or a hundred acres, you know, it's a big cost. So, somehow they've got to get it done the first time the right way, and they've got to adjust the way they apply nutrients when they no-till, or again, they'll be destined to fail. So when their no-till experiment yields forty bushel less, they're gonna say, "oh, no-till doesn't work". And, you're just

> destined to fail without the education and the understanding of the adjustments you have to make. That's, I've heard it over and over and over. And the pressure's on, if you're farming for a bank manager or a tenant or a land owner that sees your yields go down, they're gonna say, "stop doing that, go back to the conventional way, whatever that was before". So there are these barriers, these are tremendous barriers, the fear of the economics of it, and it's gonna take a lot of more education and help before farmers can afford to do that.

The scenario is likely of a crop-share lease, where yield performance impacts not only the farm operator but also the landowner or manager. The farmer describes the formidable overhead costs that may inhibit innovation by making failures expensive and allowing little room for trial-and-error. While this variable was not found to have a significant link in the quantitative portion of the study, farmers thus perceived tenancy as another dimension of the link between human-nature relationships and conservation practice.

Size

Farm size emerged out of the interviews as another factor thought to negatively influence farmers' relationship with nature and its manifestation in conservation practice. Smaller farmers depicted large-scale farmers as being apathetic and incapable of the care that smaller farmers are able to provide for the land.

> You've got your big guys that are out there constantly looking for anything on the 300...They're looking at the plaques and seeing those, they're putting the cash rent … they're not taking quite the care that they, like I said, they maybe only see the piece two or three times a year. Plant it, spray it, harvest it, that's all. I think I

> drive by a piece everyday. So I mean that's there on that, as the equipment has got bigger, the rush of farmers got bigger, to me it has got more of a convenience, when's the best is not necessarily what's the best time to put it on or when's the best time to put it on is when does it fit my schedule. I mean I've got 4,000 acres of anhydrous to put on, I'm not gonna risk it to put it all on in the spring, I'm gonna put it on in the fall, or I'm not gonna be able to sidedress that many acres so I mean I put the nitrogen out there, so I may end up losing, or those type things. … You are doing less than ideal conditions on a lot of stuff.

This excerpt was from one of a handful of interviews where the informant gave extensive descriptions of both the lack of care and the ability of large-scale operators to adjust their practice depending on the soil condition or for conservation. "They'll farm right up to the- they don't worry about no dang filter strip. Don't worry about no waterway. You know, they can't fiddle with stuff like that," said another farmer, explaining that large-scale farmers preferred open lands where "They can drop in and get in and get out of there in no time with those big machines." The absence of intimacy described between large-scale farmers and their lands suggested that the relationships of large-scale farmers with their land are more distant and apathetic.

The informants' claim that large-scale farmers may be apathetic about their land is consistent from findings in the reviewed ethnographical study of farmers in Maryland's Chesapeake Bay (Paolisso & Maloney, 2000). While many of the respondents expressed the need to care for their land to assure their living in the long-term, they thought differently of big businesses. In their view, large businesses and corporations take a more exploitative approach because unlike family farms businesses, they are able to "buy [their] way out of trouble" (p. 215).

This utilitarian approach that Paolisso and Maloney found also shares attributes with the Master concept, but are by and large consistent with the perception that large-scale farmers lack a relationship with nature.

Inflexibility

Informants further explained that the scale of the operation may impact the adoption of conservation practices by reducing the flexibility of operations. This reasoning is consistent with the perception of large farmers as being less accommodating of soil and water quality issues, but suggests that the difference in practice may be a product of logistical issues rather than how the farmers personally relate to nature.

> [Large-scale farmers] have no choice in what they do. They've got so much they've just got to cover the acres and a five acre spot that would be better off left alone or handled specially, they just don't have the time or ability to deal with it. Or maybe even 20 or 30 acres, they just don't. For example when I farmed for a big cash renter I had 60 to 70 acres of contour rows and now it's all farmed all straight up and down so they can plow it and everything else, all the no till is gone and all that. I mean they just don't, it doesn't fit with what they do and they don't do it.

Since the large-scale operator in question had taken over the farmland that the informant had for some reason given up, personal feelings may have led to this informant's attribution of the differences in their practices to the scale of operation. However, his observation of the inability of large-scale operators to make adjustments and to accommodate conservation practices is

consistent with the previous quote. Even if a farmer preferred to farm conscientiously, operation size may impose obstacles to conservation.

Size is relative

Perhaps not surprisingly, "large" was a relative term, riddled with nuances of the temporal and spatial tension in the community. A farmer of 950 acres was skeptical of "large"-scale operators with tens of thousands of acres. A retired farmer remembered, "shortly after we moved over here we got farm magazines and I read that the day would come when 160 acres was a field instead of a farm. And I told [Jonathan Steinfelsen] that we'd never see that." This operator's comments on how the size of operations had changed over time and that "there aren't that many [farmers] left in this area. When they're farming a couple thousand acres" hints that tension between newcomers and old-timers may partly be driving the perception of large-scale farmers as being apathetic towards their land. Another farmer, with 175 acres, acknowledged that "[big operators] vary from operator to operator" and that "some of them are very caring and very conscious about those conservation practices and [others] have got so big they don't care." What this farmer meant by "big" is unclear, and his general emphasis seems to be on the existence of farmers "so big they don't care." Nonetheless, these comments together warned caution against presuming the Apathy of large-scale farmers.

Comparing Interviews with survey data

Survey results contradicted this notion of farm size negatively impacting farmers' care for their land. High-end outliers in the survey whose acreages would be considered "large-scale" by all of the standards that were given in the interviews indicated a representative, and even ecocentric-tending relationship with nature. Further, the use of common conservation practices correlated positively with size (τ=.231, p=.002), indicating that larger farmers were more likely

to have adopted the practices. Thus, the quantitative data run counter to the informants' allegations that large-scale farmers lack a relationship with nature.

Absentee landowners

Informants also suggested that absentee landowners may be more apathetic. Absentee landowners are landowners who do not live in the region. One landowner, who enjoyed living on a farm with "nice black dirt," explained that the high prices made land a popular investment for non-farmers. Another observed, "They don't put anything into it to improve it, they just wanna get that check in the fall." This perception of absentee landowners as lacking a relationship with their land or interest in its ecological integrity was shared by all informants who alluded to them.

> …if everybody was good steward minded, it would be fine but we have some of the ten, twenty, fifty thousand acre farmers that live 15,000 or something miles away that don't care… they have no concern. They don't care what water runs off, they don't care what they spray where when, they carry liability insurance**.**

Thus, the suggested Apathy of absentee landowners was observed as providing little motivation for engaging in conservation practices.

These informants' perceptions of how ownership and size influence farmers' relationship with their land are not supported by the survey data and cannot be verified here. However, the fact that they talked skeptically about the level of care that others in their community showed towards the land is indicative of their own sense of care about their land and its management. Indirectly, these observations substantiate the personal and intimate nature of the informants' relationship with their land.